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GAME AS FOOD

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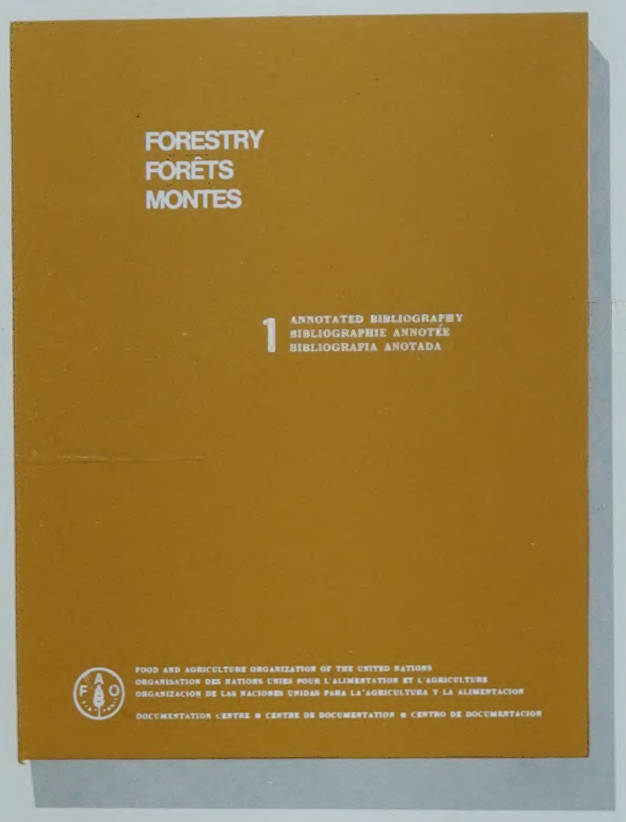

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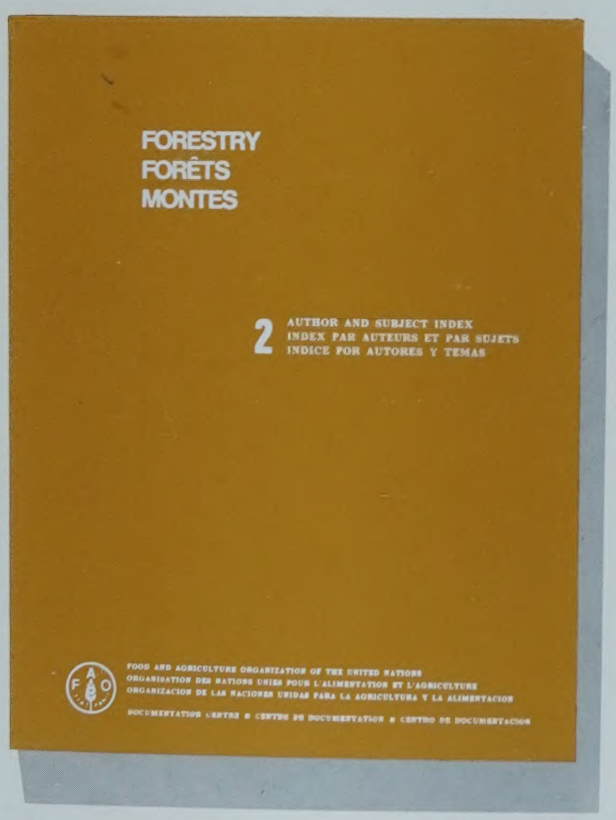

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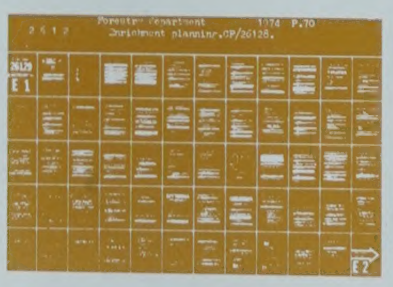

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T.M. Pasca, Editor
Forestry Department, FAO

COVER: Greater kudu
Photograph by Norman Myers. Design by Uta von Beyme

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Game as food

A report on its significance in Africa and Latin America

Antoon de Vos

For three million years or more man has been eating wildlife of various kinds. Primitive man harvested a great variety of wild animal foods, as is evidenced by the many species of mammals, birds, reptiles, amphibians, fish and also invertebrates which are still being collected today by the Kalahari Bushmen and the pygmies of the African tropical forest zone.

Primitive people must have been largely opportunistic in their food habits, although they must have been subject to certain taboos and food preferences as well, which is still true today.

Evidence obtained by anthropologists in various parts of the world indicates that primitive man already had certain preferences in his use of animal protein. For example, Bökönyi (1975) stated that the aurochs was preferred by hunters in the Lengyel culture in west Hungary.

In Africa an amazing variety of wildlife species are eaten, including all wild ungulates, primates, hyraxes (*Hyracoidea*), rodents, all cats and many species of birds, reptiles and amphibians. A long detailed list of wild mammals, birds and reptiles used as food in Africa was prepared by Jardin (1970). Recent data on the use of wildlife as a source of food in Africa are listed in Table 1. The utilization rate of monkey in west Africa is high, so much so that the continued existence of some of these species is endangered by this practice (Asibey, 1974). Chimpanzees and pigmy-chimpanzees are also eaten in some west African countries. Monkey flesh is often preferred to other meat, as indicated by high prices on local markets. A small monkey carcass (*Allenopithecus nigroviridis*) cost US$7 at the Kisangani market in Zaire in 1976.

ANTOON DE VOS is a wildlife biologist who has served on a number of FAO wildlife projects.

Bushmeat in west Africa

A wide range of animals currently provide edible meat in west Africa (Tables 2 and 3). Among the mammals, rodents and antelope play an important role and among the latter duikers (*Cephalophus* spp. and *Sylvicapra* spp.) and bushbuck (*Tragelaphus*) make an important contribution to the diet. In the past apparently a smaller number of animals was used for the daily human diet, because these people could afford to be more selective in their food habits. Bush babies (*Galago* spp.) and African hedgehogs (*Atelerix* spp.) have become important food items only recently.

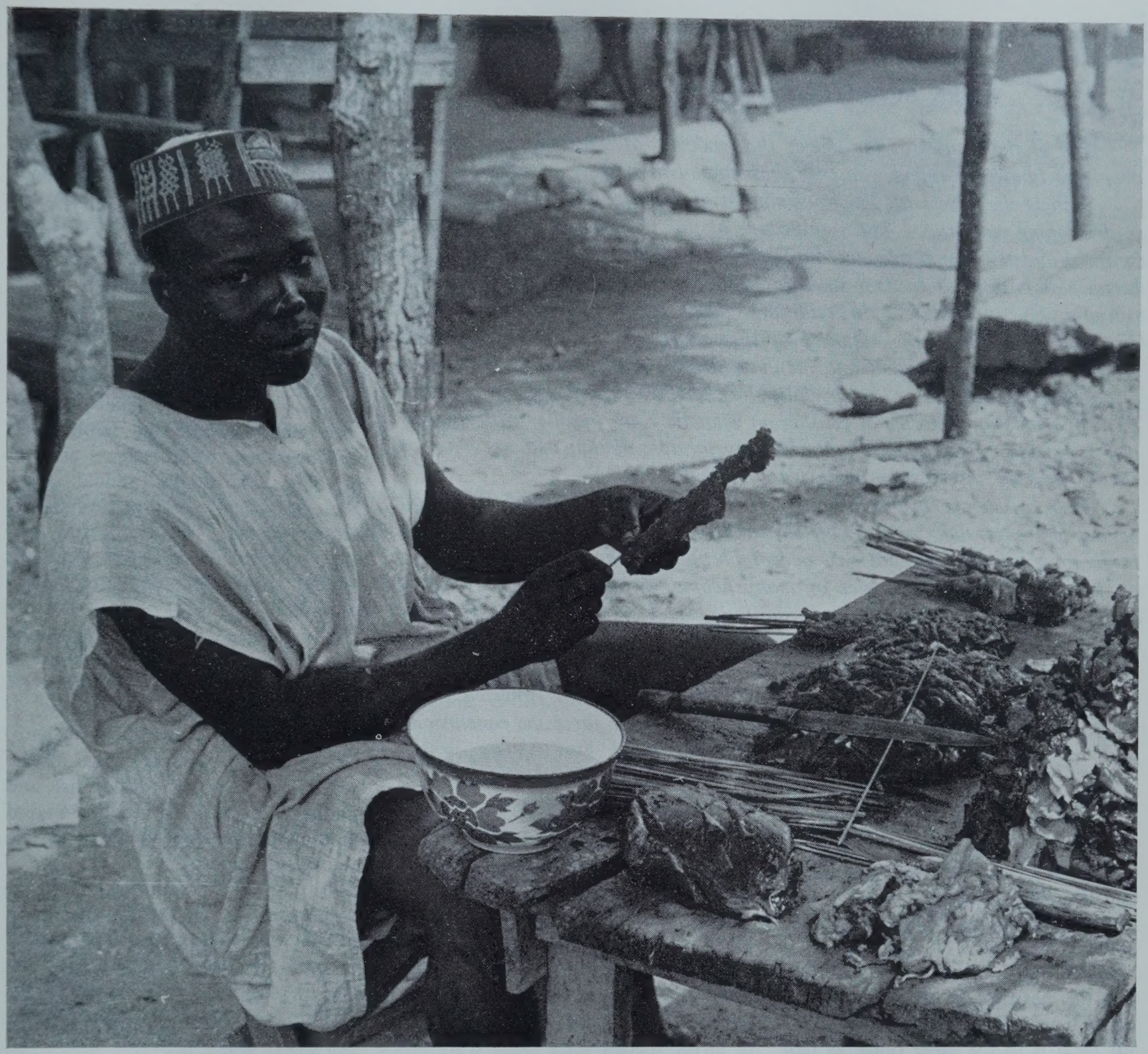
Virtually all species of wildlife — mammals, birds, reptiles, and invertebrates — serve as sources of wild meat in Ghana, as is the case in many other countries. The most popular are the rodents and certain wild ungulates. Rats, cats and dogs may occasionally also "pass" for game (Clottey, 1968).

In some parts of Ghana, as much as 73% of locally produced meat may come from wild animals, particularly from some of the smaller types such as grasscutters (*Thryonomys* spp.), hares (*Lepus* spp.) and giant rats (*Cricetomys gambianus*). The amount of bushmeat purchased in one market in Accra is shown in Table 3.

Detailed recent statistics on the harvest from various sources are available for Botswana (von Richter, 1976): in 1975, 43 187 head of game were sold and 14 630 were shot. Since, with the exception of leopard, lion and ostrich, these are all large to medium-sized ungulates, this represents a vast quantity of meat. In 1971 there were 325 532 head of game, again mainly ungulates shot by safari and non-safari hunters in Botswana.

As already noted, rodents form a significant portion of the total amount of bushmeat consumed, particularly in west Africa. The use of rodents as food in tropical Africa was reviewed by den Hartog and de Vos (1973). However, this use is not always adequately reflected in statistics, as food consumption surveys generally record all foods obtained by hunting or trapping indiscriminately under the heading of "bushmeat" in English or *gibier* in French. Generally these figures also do not include the small animals which are collected by children. Therefore, the few statistics that are available record minimum figures only.

Rodents may be of greater importance for human consumption in many



PREPARING SKEWERS OF GAME MEAT AT A ROADSIDE CHOP BAR IN NIGERIA

game is preferred

rural areas than the bigger animals. This is because:

- They generally do not come under the game laws and can therefore be harvested continuously.
- The high turnover rate allows for a high sustained yield without depletion of the populations.
- Rodents are very numerous in relatively densely populated areas where larger animals are scarce.

Among the rodents, two forms are widely consumed, particularly in West Africa: the giant rat (*Cricetomys gambianus* and *Cricetomys emini*), and the cane-rat or grasscutter (*Thryonomys swinderianus*).

Another very valuable rodent is the springhare (*Pedetes capensis forster*), which is widely distributed throughout southern Africa. This rodent, which may breed continuously and reaches an adult weight of 2.7-3.5 kg (Butynski, 1973) has been the subject of some interesting statistics about its use in Botswana. Butynski estimates that the total number killed by Bushmen is more than 346 000 annually and that the number killed by Botswana hunters amounts to 2.2 million per year. This represents a total of 2.2 million kg of springhare meat every year, the equivalent to the amount of meat obtainable from 20 000 head of cattle.

Some data obtained on the average daily meat consumption in Nigeria, including rodents, are shown in Table 4. In Table 5 are listed the kinds of rodents that are consumed throughout Africa.

Rodent meat can be purchased in many cities and towns in West Africa. Insofar as can be ascertained, of all

WHEN SCIENTISTS PUT ON BLINDERS

One of the ironies of the age is the tendency of scientifically educated people to ignore or reject whatever they cannot measure.

Such is the case with the consumption of wildlife of all kinds for food in developing countries. The significance of this resource is largely ignored by nutritionists, animal production experts and even some wildlife biologists because it is difficult to find statistics about the gathering, marketing and consumption of wildlife. In addition, these foods are mostly strange or even repugnant to the majority of specialists who are working so hard to increase food production and human nutrition levels among the peoples of developing countries. The specialists are inclined to think of the improvement of man's lot in terms of passing on what they are familiar with in their own lives, ideas and things which are often foreign, distant and unconnected to the lives of those whom they want to help.

This article is by a scientist who thinks differently. His point of departure is that wildlife of all kinds, from maggots and rodents to large game animals, are not only acceptable food but are to varying degrees an important part of the diet of many people throughout the developing world. Furthermore, he observes, wildlife is usually preferred food whenever it is a part of the culture. Why, then, should these resources not be better husbanded and developed?

The observations and data refer to Africa and Latin America but a study of the same conditions in Asia would yield similar facts and conclusions.

The Editor

African rodents only the grasscutter and the palm squirrel have been analysed for their food composition (Bergeret *et al.*, 1957). No information is available on the biological value (BV) and the net protein utilization (NPU) of rodents. The chemical score of rat meat is in the same range as that of other foods of animal origin (den Hartog and de Vos, 1973).

Unfortunately, far less quantitative data on the use of wildlife for human food are available for South America than for Africa, but particularly in the forest zone and to a lesser extent in the savanna zone this is still considerable. Most primitive Indian tribes base their animal protein intake almost exclusively on wildlife, and settler communities also make considerable use of this resource (Smith, 1976).

Amazonian fauna has historically been important as a source of food. Birds, monkeys, turtles, fish, manatee, deer, paca, peccaries, capybara, tapir, sloth, ants and grubs are only some of the animals mentioned in the literature as having been eaten and still used as food in Brazil today.

Smith (1976) assessed the importance of wild meat in the diet of settlers in rain forest and second growth areas along Brazil's Transamazon Highway. He considers his data biased in favour of larger species since settlers are less likely to report smaller game. During a 12-month period in 1973/74 (Table 6), a total of 3 214 kg of game was taken within a 100-km^2 hunting area of Agrovila Nova Fronteira. Allowing for an average weight loss of 40%, the actual amount of game meat consumed was about 1 929 kg or an estimated 5 grams of protein intake per day. During a similar 12-month period of observation in 1973/74 (Table 8) in the vicinity of Leonardo da Vinci, a total of 3 389 kg was taken, or an estimated 2 033 kg consumed. This supplied about 20% of the protein requirements of the community. A much smaller yield, 761 kg or only 2% of protein requirements, was obtained around Coco Chato because of 15 years of hunting and habitat alteration.

Instead of cropping more abundant mammals, such as rodents and marsupials, settlers in forested areas concentrate on relatively large taxa such as peccary, tapir and brocket deer, composing 89% of the game take by weight in the vicinity of Nova Fronteira and Leonardo da Vinci (Tables 6, 8). Only when the larger species become scarce in heavily hunted and modified habitats are rodents significantly represented in the annual kill. Thus pacas and agoutis account for 39% of the game taken around Coco Chato, where the habitat has been degraded, while rodents account for only 3% of the annual game take by weight in predominantly forested areas. However, rats and mice, a source of food for some aboriginal groups, are not eaten by the colonists.

Wild birds, a minor source of animal protein to colonists in the study areas, account for only 0.6% of the yield by weight in forested areas (Tables 6, 8) and 2.6% in the vicinity of Coco Chato.

FAO (1969) reported that in the Ucayli region of the Amazon fish and wildlife accounted for about 85% of the animal protein consumed by people in rural areas.

The capybara, a giant rodent weighing between 30 and 50 kg, has long been the object of intense exploitation. It occurs in large numbers over extensive areas of South America. In Argentina, capybaras are hunted everywhere for their meat and hides and several ranches in Venezuela raise them commercially.

A comparison of the production efficiency of capybaras and cattle has shown that the former are 3.5 times more efficient than the latter and also six times more efficient than the latter in reproductive performance under conditions prevailing on floodplain savannas. This permits off-take rates of about 40% without detriment to the productive potential (Gonzáles Jiménez, 1977).

Preferred species

The rodent called " plains viscacha " (*Lagostomus maximus*) which inhabits warrens in the pampas of Argentina

TABLE 1. — **Terrestrial wildlife as a source of food in selected countries of Africa**

Country	Food consumption and species concerned	Source
Botswana	The estimated consumption of game meat was 60% per person per annum for the country as a whole and for the Kalahari area 16.4 kg per person per annum.	VON RICHTER, 1969
	Over 50 species of wild animals, ranging from elephant through ungulates to rodents, bats and small birds provide animal protein exceeding 90.7 kg per person per annum in some areas and contribute some 40% of their diet.	CHILD, 1970
	3.3 million kg of meat from springhare obtained by Botswana hunters.	BUTYNSKI, 1973
Ethiopia	Mice and giant rats in the tropical western border area.	GOVERNMENT QUESTIONNAIRE, 1972
Ghana	About 75% of the population depends largely on traditional sources of protein supply, mainly wildlife, including fish, insects, caterpillars, maggots and snails.	ASIBEY, 1974
	During the period Dec. 1968 - June 1970 (17 months) a total of 157 809 kg of bushmeat from 13 species of animals was sold in Accra in one market only.	ASIBEY, 1974
Ivory Coast	In the northern part of the country 27 grams of bushmeat were consumed per person per day.	ASIBEY, 1974
Morocco	Squirrel and porcupines are eaten.	DEN HARTOG AND DE VOS, 1973
Nigeria	19% of the locally produced food for the year 1965/66 was game consumed in rural areas.	CHARTER, 1971
	The Isoko tribe (Niger delta) obtain 20 g/day of animal protein, mainly game.	NICOL, 1953
	Game constitutes about 20% of the mean annual consumption of animal protein by people in rural areas.	AJAYI, 1971
Rhodesia	Game yielded 5-10% more than the beef industry at a conservative estimate of 2.5 million kg.	ROTH, 1966
	The Shoma people hunt and consume mice.	GELFAND, 1971
Senegal	A minimum consumption rate of 373 631 metric tons of wild mammals and birds per annum for the country's human population of 296 619.	CREMOUX, 1963
South Africa	Thirty-eight species of wild mammals (see Table 8).	QUINN, 1959
Sudan	Rats and field mice are eaten.	CULWICK, 1950
Togo	Various species of wildlife, including rodents, are eaten. The per caput per day intake of rodents varies from 0.5-12 g.	PÉRISSÉ, 1958
Zaire	75% of animal protein comes from wild sources, including mainly three species of *Cephalophus* and three species of *Cercopithecus*. Rats and other rodents are also eaten.	HEYMANS AND MAURICE, 1973 ADRIAENS, 1951
Zambia	22% of those interviewed in the Serenji district reported having eaten small animals, including rats, mice and mole rats.	THOMSON, 1954

is hunted and consumed as food. The meat of this animal is well liked and can be bought tinned. In Peru, Bolivia, Chile and Argentina along the Andes and their foothills, mountain viscachas (*Lagidium viscaccia*) are also hunted for food (Walter, 1964).

Wetterberg *et al.* (1976) obtained the following list of preferred species in Brazil based on personal interviews held with the management of 23 restaurants in Manaus. The first 10 species or groups of related species on the following list were most in demand and freshwater turtle meat was the most popular dish with the general public.

Turtle (*Podocnemis expansa*, *P. unifilis* and others)

Paca (*Cuniculus paca*)

Deer (*Mazama* sp.)

Tapir (*Tapirus terrestris*)

Peccary (*Tayassu tajacu* and *Tayassu pecari*)

Armadillo (Dasypodidae var.)

Capybara (*Hydrochoerus hydrochaeris*)

Wild duck (Anatidae var.)

Agouti (*Dasyprocta* sp.)

Tortoise (*Geochelone* sp.)

Boa constrictor (*Constrictor constrictor*)

Tinamou (Tinamidae var.)

Howler monkey (*Alouatta fusea*).

Cultural factors

Many cultural and religious factors exist in various parts of the world which prevent or inhibit people from using certain species of wildlife. However, these are often put aside by starving and desperate people.

Several societies forbid their members to eat a particular animal which, according to their legends, aided the group's original founders in one way or another and is, therefore, honoured. Squirrels, for example, considered sacred to the Afana (Ibibious, Nigeria), may not be killed and consumed by them (Messenger, 1971). Several animals, including the cow and the monkey, are considered sacred by the Hindu religion and may, therefore, not be eaten.

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Favourite foods, some wild, some being domesticated

1. The grey duiker (*Sylvicapra grimmia*) is a small antelope living throughout the savannah woodlands of Africa.

2. Capybara (*Hydrochoerus hydrochaeris*), the world's largest rodents, are found in most of tropical Latin America. Wild and semi-domesticated, the capybara has been a source of meat for man for centuries. They reach the size of a small pig and multiply rapidly.

3. Called the "grasscutter" in Ghana and the "cutting-grass" in Nigeria, this large rodent (*Thryonomye swinderianus*) weighs up to two kg. It is a popular delicacy in West Africa, especially in forest areas, and has been successfully domesticated in Ghana.

4. Bushfowl (*Francolinus bicalcaratus*) are common to the savannah lands of West Africa. It is one of many species of francolin, a game bird with very tasty white meat. Efforts are being made to domesticate it in Nigeria.

5. Guinea fowl (*Numida meleagria galeata*) are found as wild birds only in Africa. They have been domesticated in many parts of the world for centuries. Villagers in Africa commonly collect wild guinea fowl eggs and hatch them under chickens.

6. Collecting giant snails (*Archachatina calachatina marginata*) like these is a favourite occupation for children in West Africa, where they are a delicacy and fetch a high price at city markets.

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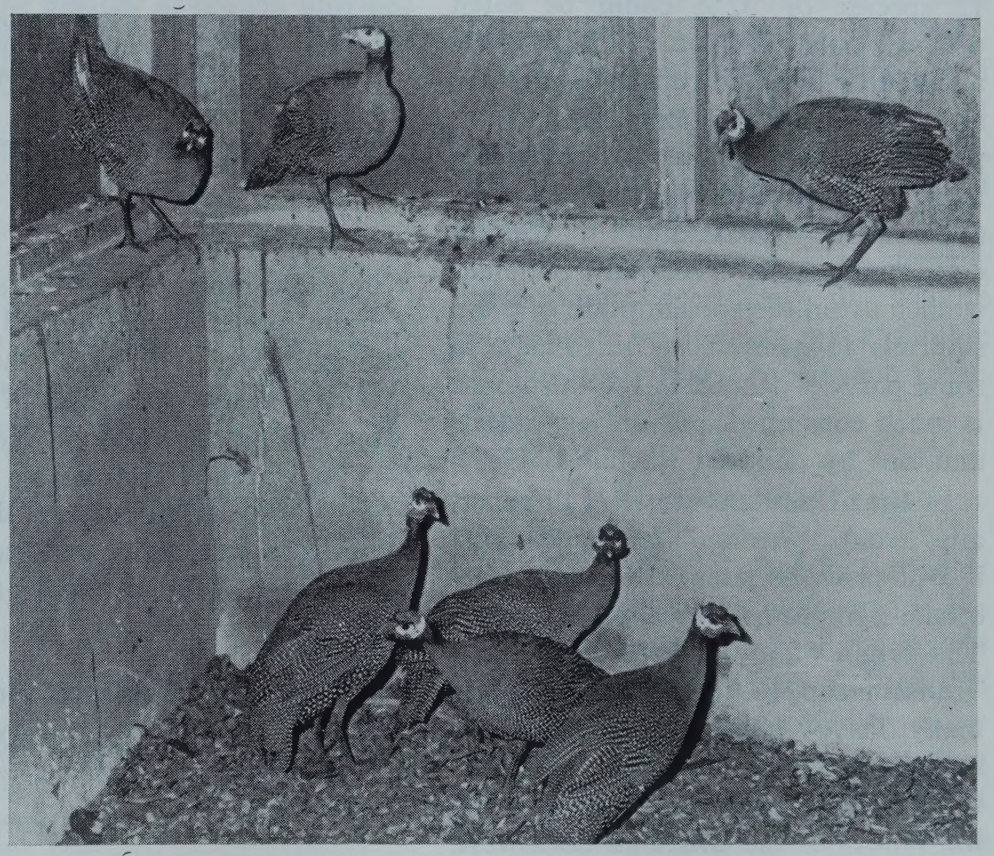

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Many animals are considered clan or totem animals and therefore may not be killed and eaten by members of a particular clan or a similar social group.

Certain wild animals may not be killed or touched because of formal religious dicta, traditional taboos or prejudices. Muslims, for example, do not eat pigs, scavengers and avoid eating hares, rats and mice. For this reason, the Fulani and Peul people of Mali do not eat rodents.

Sex and age taboos in dietary habits may be rather pronounced. Quinn (1959), who made a detailed study of these habits among the Pedi people of South Africa, showed (Table 7) that among 37 species of wild mammals, 12 species or 32% could be eaten only by men and boys. Temporary avoidances of some rodent species are also sometimes prescribed. For example, in Senegal women are restrained from eating bush rats during pregnancy (de Garine, 1962) and in Cameroon among the Evodoula pregnant women avoid the consumption of palm squirrels (Masseyeff *et al.*, 1958). In some parts of Rhodesia the fat mouse is much consumed, but only by adults and not by children (Geifand, 1971).

In Brazil, settlers who feel ill generally avoid "strong" game, thinking it will provoke latent disease or exacerbate symptoms of a chronic illness. The origin of the food avoidances of Transamazon settlers is unclear, but many have undoubtedly been absorbed, in a modified form, from aboriginal cultures (Smith, 1976). Among the Witoto of the Brazilian northwest, for example, tapir meat is considered to be very strong, especially for women, and is thus eaten sparingly (Whiffen, 1915).

Some of the taboos or prejudices referred to are deep-seated and cannot be readily changed. Yet, education in the principles of nutrition and meat hygiene may gradually modify these views which may be rather ill advised in those areas where a scarcity of animal protein prevails.

There are, also, regional and tribal preferences for special kinds of wild meat, as for example in Ghana the Kwahus prefer bats and the people in the Vzima area prefer monkeys. Among the many edible animal species, the Kung Bushmen of Botswana have definite preferences: only 17 species comprise over 90% of the animal diet by weight (R. Lee, The Dobe Area Bushmen. Unpublished paper, No. 4, Harvard University).

Finally, some animals are thought to be of medicinal value and eaten when so required. For example, rats (*Rattus* spp.) are given to children in Ghana who are suffering from whooping cough (Asibey, 1974).

The data shown in the previous sections of this paper should convince even the most critical reader that wildlife is still an important source of protein for human consumption even when little or no effort is made toward

TABLE 2. — **Some of the wild animals eaten in Ghana**

Rodents	Besides large rodents such as giant rats (*Cricetomys* spp.), grasscutters (*Thryonomys* spp.), hares (*Lepus* spp.), and porcupines (*Hystrix* spp. and *Atherurus* spp.), which are generally eaten by both old and young people. All squirrels (*Anomalurus* spp., *Funisciurus* spp., *Protoxerus* spp., *Heliosciurus* spp., *Idiurus* spp., etc.) are eaten.
Bats	Most fruit-bats (*Eidolon* spp.) are eaten. They may even be smoked and packed in large quantities for markets in Accra, Kumasi, and other population centres.
Anteaters	All species of pangolins (*Manis* spp.) and aardvark (*Orycteropus capensis*) are a delicacy, and their meat fetches high prices.
Primates	All monkeys (*Procolobus* spp., *Cercopithecus* spp., and *Papio* spp.) as well as chimpanzees (*Pan troglodytes*) form a regular item of diet where they are available.
Birds	Most birds, including birds of prey, sunbirds, and all herons, including battle egrets (*Bubulcus ibis*), are eaten.
Reptiles	All tortoises, turtles, both monitor lizards (*Varanus* spp.), African python (*Python sebae*), Gaboon viper (*Bitis gabonica*), puff adder (*Bitis arietans*), and the night adder (*Causus maculatus*), are eaten. Children may eat agama lizards (*Agama agama*).
Others	Insects such as brown ants are eaten, while the maggot of the palm beetle (*Phyncophorus phoenicals*) is highly prized. African giant snail (*Archachatina* sp.) is eaten in large quantities, and in some areas it is the major source of protein.

Source: Asibey, 1974.

TABLE 3. — **Bushmeat record for the Kantamanto market, Accra, Ghana**
(December 1968 - June 1970)

Species	Weight	Weight per specimen
	..... *Kilograms*	
Grasscutter (*Thryonomys* spp.)	117.226	4.8
Grey duiker (*Sylvicapra grimmia*)	26.406	6.7
Bushbuck (*Tragelaphus scriptus*)	4.225	22.5
Royal antelope (*Neotragus pygmaeus*)	3.682	2.4
Black duiker (*Cephalophus niger*)	3.498	15.8
Green monkey (*Cercopithecus aethiops*)	1.055	3.2
Bay duiker (*Cephalophus dorsalis*)	701	8.9
Bushpig (*Potamochoerus porcus*)	561	26.7
Brush-tailed porcupine (*Atheaurus africanus*)	357	3.6
Giant rat (*Cricetomys gambianus*)	121	1.6
Monitor lizards (*Varanus* spp.)	92	4.2
Two-spotted palm-civet (*Nandinia binotata*)	47	3.1
Togo hare (*Lepus capensis*)	8	1.7

Source: Asibey, 1974.

the management of this resource. It is my contention, and that of others who have concerned themselves with this field (e.g. Talbot, 1966; Mossman and Mossman, 1976), that there are many areas in the world where livestock or agricultural production is slight but where wild animals could be utilized much more efficiently for food. In these areas high production of wildlife could be maintained on a sustained yield basis without adversely affecting the carrying capacity of the habitat. On such lands wild animals offer a greater potential for a sustained production of meat and other animal products than domestic stock. Evidence for this conclusion comes from comparisons between domestic livestock and wildlife. Wildlife is better adapted to prevailing ecological conditions, more able to utilize the available plant material and requires less water (de Vos, 1973). Wildlife species are also more suited to prevailing climatic conditions than most introduced stock. As detailed by Ledger (1963), the carcasses of wild animals contain far less fat than those of domestic stock. The production of lean meat is a more efficient use of fodder than is the production of fat. Consequently, in terms of meat production wild animals with virtually no fat make far more efficient use of the available vegetation than do domestic animals.

King and Heath (1975) have demonstrated that the species with the greatest potential in a semi-arid environment in Africa is the oryx. It is able to gain weight on forage that is below the capacity of maintaining cattle, and has half the drinking water requirements of dorper sheep and one quarter of Boran cattle when the species are equated on a metabolic weight basis. The same might be true for the addox which is also very well adapted to arid environments. They also believe that the wild African buffalo (*Syncerus caffer*) might prove most useful in the exploitation of coarse-grass areas infested with tsetse fly where meat is in short supply.

The springbok (*Antidorcas marsupialis*) of South Africa has been shown to have a great potential for game ranching (Skinner, 1973). The kudu (*Tragelaphus strepsiceros*) is also a most useful species for game ranching purposes (Young, 1973).

Persistent claims have been lodged on behalf of the eland (*Taurotragus oryx*), being large, fast-growing, economic in its use of water, resistant to trypanosomiasis and having a carcass of good quality (Posselt, 1963). Yet, despite its several ecological and physiological adaptations, the eland is still not the ideal animal for the semi-arid rangelands of Africa (Tribe and Pratt, 1973) as compared to certain breeds of beef cattle.

There is strong evidence favouring the use of capybara in marginal areas of the tropics to improve production of animal proteins, especially where domestic species are not as efficient in utilizing the primary production of these ecosystems (González Jiménez and Parra, 1973).

TABLE 4. — **Average daily consumption of domestic and wild animals and fish and the amount of protein provided in the diet of the Isoko farmers of the Niger delta, Nigeria**

Food	Edible portion in grams	Protein content in grams
	... *Grams* ...	
Fish (fresh)	18	3.0
(dried)	18	9.0
Monkey (fresh).	8	1.2
(dried)	7	3.2
Goat	6	1.0
Pangolin and porcupine . .	5	0.9
Grasscutter and giant rat .	3	0.6
African snail	3	0.6
Palm weevils	1	0.1
Frogs	3	0.6
Total animal protein (Total vegetable protein)		20.2 (26.1)

Source: Nicol, 1953.

Mentioned examples are indicative of the potential of wildlife in the nutrition of man in Africa and South America.

A by-product of forestry

The pressing need to feed the world population adds an important note to the need to harvest wildlife to yield meat. In selecting targets for increasing the level of animal protein intake, every possible priority should be given to those sources which occur "wild" and have little problems with management, feed procurement, harvesting, processing, markets and consumer acceptance (Clottey, 1968).

Although wildlife still is a valuable source of nutrition for man, increasingly the land from which it has been harvested is subjected to various types of uses which are detrimental to wildlife production. Frequently this includes habitat changes.

Wildlife continues to be a by-product of other types of land use and this is particularly the case in forestry. In fact, secondary forests have a higher carrying capacity for wild animals than primary forests. There is, therefore, a high potential for harvesting wild animals in well-managed forests. It becomes increasingly clear, however, that in order to obtain a sustained yield at a high carrying-capacity level, it will become necessary to manage certain areas specifically for wildlife production, or at least make wildlife a major type of land use in such areas.

Game ranching

Game ranching is a method of wildlife production which may provide the immediate, substantial and tangible benefits that are required, and for this reason it has been advocated by many authors. In addition to providing protein for hungry people, game meat is nutritionally superior to domestic meat because of its higher protein to fat ratio (Ledger, 1963). The practice of game ranching was initially developed in southern Africa, but similar goals can be achieved in many developing areas. In fact, it is a form of land use that can be woven into the cultural fabric of many societies. This practice is in fact closely akin to the ranching of domestic animals (Mossman and Mossman, 1976).

Both biotic and human factors are involved in deciding whether one or more species should be raised on a game ranch. In general more species can be ranched in moist and warm environments than in cold or dry areas. For most human uses, larger species

or species that aggregate in large numbers appear most suitable (Mossman and Mossman, *ibid.*).

As a rule, less than the annual recruitment to the population should be cropped. As cropping of a formerly unharvested population proceeds, compensatory ecological, population and individual physiological adjustments come into play and the rate of increase of the population usually increases. It is this productivity that needs to be enhanced through wildlife and range management efforts (Mossman and Mossman, *ibid.*). The task of estimating a safe of-take involves discovering the rate of increase of the population at various levels below its carrying-capacity density (Caughley, 1972).

Game ranching should concentrate on areas of marginal value to conventional livestock. Mossman and Mossman (*ibid.*) state that it is entirely possible that under subsistence conditions in the sub-humid tropics, a game ranch of 10 000 hectares of marginal land could support 1 000 people as soon as optimum productivity is attained.

So far no particular efforts have been made to manage either the population or the habitats of wild rodents used for food in Africa. As long as adequate supplies of these animals were available for food, rural people did not see any need for management other than hunting or trapping. With rapidly increasing human populations, and better prices offered on the urban markets, the situation has changed and there is now an incentive for rural people to spend time and effort to increase production of these rodents. E.O.A. Asibey, Chief Game and Wildlife Officer of Ghana, and a leading authority on the utilization of west African rodents, recognized this some years ago and initiated the production of grasscutter (*Thryonomys swinderianus*) in captivity on an experimental basis. His efforts were successful and proved that these rodents reproduce and grow well in captivity. Ghanian farmers raising grasscutters are getting high prices at city markets (den Hartog and de Vos, 1973). The most recent development in Ghana is that "game production reserves" have been set up in the wild for production of grasscutters and other small game.

It is still too early to tell whether these experiments can be applied on a wider scale in west Africa and also whether it could be economically feasible to have large-scale production of captive animals. Through quite simple manipulations of the habitat, advancing or changing ecological succession, considerable, although temporary, increases in populations can be expected of wild animals. These manipulations, such as the use of fire, or the seeding of plants particularly palatable to rodents, can be undertaken usually as an integral part of farming operations without much effort by

TABLE 5. — **Kinds of rodents consumed in Africa**

Common name	Scientific name	Area of consumption	Frequency of consumption
1. Squirrel, palm squirrel	*Xerus*, *Protoxerus*, *Epixerus*, *Paraxerus* spp., *Heliosciurus*, *Funisciurus*, *Atlantoxerus getulus*	East Africa South Africa West Africa South Morocco	Fairly common
2. Rat, mouse	*Oenomys*, *Rattus*, *Cricetomys*, *Rhabdomys*, *Arvicanthis*, *Steatomys*, *Jaculus*, *Gerbillus* spp.	Africa	Very common
3. Porcupines	*Hystrix*, *Atherurus* spp.	Tropical Africa	Fairly common
4. Grasscutter (smoked)	*Thryonomys* (*Choeromys*) spp.	West Africa South Africa	Very common

Source: Jardin, C., List of foods used in Africa. FAO, Rome, 1970. Some information on squirrels is given by Child, G.S., FAO, Accra, 1972.

TABLE 6. — **Game taken near Agrovila Nova Fronteira, Brazil**
(September 1973 - August 1974)

COMMON NAME	Scientific name	No. killed	Total	Total
			Kg	%
South American tapir	*Tapirus terrestris*	8	1 180	36.7
White-lipped peccary	*Tayassu pecari*	52	1 145	35.6
Brocket deer	*Mazama americana*	15	415	12.9
Collared peccary	*Tayassu tajacu*	8	109.5	3.4
Jaguar	*Felis onca*	1	80	2.5
Tortoise	*Geochelone* sp.	21	62	1.9
Paca	*Agouti paca*	8	59	1.8
Rabbit	*Sylvilagus brasiliensis*	31	32.7	1.0
Agouti	*Dasyprocta* sp.	14	32	1.0
Puma	*Felis concolor*	1	24	0.7
Nine-banded armadillo	*Dasypus novemcinctus*	6	16.4	0.5
Giant anteater	*Myrmecophaga tridactyla*	1	15	0.5
Black jaguar	*Felis onca*	1	12	0.4
Razor-billed curassow	*Mitu mitu*	4	11.9	0.4
White-crested guan	*Penelope pileata*	7	9	0.3
Howler monkey	*Alouatta belzebub*	1	5	0.1
Ruddy ground-dove	*Columbina talpacoti*	26	2.1	0.06
Dark-winged trumpeter	*Psophia viridis*	1	2	0.06
Brazilian tinamou	*Crypturellus strigulosus*	2	0.8	0.02
Marbled wood-quail	*Odontophorus gaganensis*	1	0.3	0.009
Cream-coloured woodpecker	*Celeus flavus*	1	0.2	0.006

Source: Smith, 1976.

the farmer concerned. Farmers should be taught how to anticipate considerable population increases of certain rodents, how to detect signs of increasing abundance and to harvest large numbers of these animals when peak populations occur. This should not prove to be particularly difficult because most farmers are already familiar with these phenomena to some extent.

Three to four years after forest plantations have been established there is normally a dense herbaceous cover on the ground. This offers good conditions for high populations of rodents. If these animals are not utilized, they often damage the young trees by girdling or barking. It is, therefore, a good silvicultural practice to induce farmers to harvest these rodents before damage to trees occurs. Similarly, the damage to field or garden crops can be reduced by removing excess populations of rodents from adjacent fields at the right time.

It will be necessary to develop better harvesting techniques for rodents in the wild to ensure a sustained yield, and also to improve processing, storage and marketing methods.

It is evident that, were continuous and better statistical data available, the value of wildlife as a source of protein would make a greater impression on food and nutrition policy-makers and agricultural economists. They would then take wildlife conservation much more seriously than they do now.

Because of the accelerating land-use pressures which can be readily observed in most parts of the developing world, the possibility of establishing special wildlife management areas to support recreational and local hunting as a form of land use should be explored. At the same time these areas would be protected from competing and/or deleterious forms of land use. Efforts are now under way in Botswana (von Richter, 1976) to establish such areas with the objective in mind to obtain optimum returns and benefits from wildlife and, wherever possible, to incorporate existing land-use practices.

Wildlife is not a panacea for solving global food problems. There are no panacea for such problems. But in many parts of the world the potential of wildlife for contributing to man's well-being is much greater than is appreciated by specialists and government authorities dealing with food and nutrition.

It is especially true in developing countries that people who live in and on the countryside, or who live in cities and towns but maintain rural ways and tastes, give particular importance to the nutritional and the cultural value of their local wildlife foods. Such values, which are also among the important pleasures of daily life, should not be minimized or removed in the name of progress. Unfortunately, this is exactly what some food and nutrition specialists are inclined to do. Out of their own cultural prejudices they may minimize, or look down upon, or simply not see certain indigenous foods and ways of life. Instead, the specialists should be studying and making use of traditional foods and

TABLE 7. — **Mammals of Sekukuniland in southern Africa and their use by the Pedi tribe**

COMMON NAME	Scientific name	Eaten by
Red hare	*Pronolagus randensis*	Entire family
Vervet monkey	*Cercopithecus aethiops*	Men and boys only
Blue wildebeest	*Connochaetes taurinus*	Entire family
Warthog	*Phacocoerus aethiopicus*	" "
Klipspringer	*Oreotragus oreotragus*	" "
Hippopotamus	*Hippopotamus amphibius*	" "
Reedbuck	*Redunca arundinum*	" "
Cane-rat	*Thryonomys swinderianus*	Men and boys only
Mountain reedbuck	*Redunca geoffroyi*	Entire family
Galago	*Galago senegalensis*	Men and boys only
Cape hare	*Lepus capensis*	Entire family
Southern bush hare	*Lepus saxatilis*	" "
Suricate	*Suricata suricatta*	Men and boys only
Pole cat	*Ictonyx galeata*	Entire family
African porcupine	*Hystrix galeata*	Men and boys only
Rock dassie	*Procavia capensis*	Entire family
Wildcat	*Felis libyca*	Men and boys only
Impala	*Aepyceros melampus*	Entire family
Sable antilope	*Hippotragus niger*	" "
Eland	*Taurotragus oryx*	" "
Steenbuck	*Raphicerus campestris*	" "
Grey duiker	*Sylvicapra grimmia*	" "
Grant's zebra	*Equus burchelli*	" "
Hedgehog	*Erinaceus frontalis*	" "
Yellow-footed squirrel	*Paraxerus cepapi*	Men and boys only
Koaterbuck	*Kobus ellipsiprymnus*	Entire family
Bushbuck	*Tragelaphus scriptus*	" "
Aardwolf	*Proteles cristatus*	Men and boys only
Antbear	*Orycteropus afer*	" " " "
Kudu	*Tragelaphus strepsiceros*	Entire family
Giraffe	*Giraffa camelopardalis*	" "
African elephant	*Loxodonta africana*	" "
Springhare	*Pedetes capensis*	" "
Springbuck	*Antidorcas marsupialis*	" "
Large-spotted genet	*Genetta tigrina*	Men and boys only
Black rhinoceros	*Diceros bicornis*	Entire family
Baboon	*Papio ursinus*	Men and boys only

Source: Quinn, 1959.

methods of food gathering. Better food and nutrition can often be achieved more rapidly and with greater local acceptance when the production or gathering methods of familiar foods are improved rather than by putting something strange on the table. ■

TABLE 8. — **Game taken near Agrovila Leonardo da Vinci, Brazil**
(December 1973 - August 1974)

COMMON NAME	Scientific name	No. killed	Total	Total
			Kg	%
White-lipped peccary	*Tayassu pecari*	52	1 166	46.5
South American tapir	*Tapirus terrestris*	6	490	19.6
Brocket deer	*Mazama americana*	15	340	13.6
Collared peccary	*Tayassu tajacu*	18	203	8.1
Tortoise	*Geochelone* sp.	36	102	4.1
Nine-banded armadillo	*Dasypus novemcinctus*	29	75.9	3.0
Paca	*Agouti paca*	10	55.7	2.2
Agouti	*Dasyprocta* sp.	17	46.7	1.9
Eight-banded armadillo	*Dasypus kappleri*	1	12	0.5
White-crested guan	*Penelope pileata*	5	9.5	0.4
Razor-billed curassow	*Mitu mitu*	1	3.5	0.1
Blue-headed parrot	*Pionus menstruus*	1	0.2	—

Source: Smith, 1976.

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Game farming is a reality

To rely only on hunting means the extinction of choice species

R.S. Surujbally

Ours is a hungry planet. The "green revolution," if not finished, is stagnating to the point of non-functionability. Famine and malnutrition are the two faces of the global food disaster, and neither can be solved without tackling the other aspects of the planetary crises: population, development, trade armaments and resources. It is with one facet of this utilization of natural resources, game ranching, that this article is concerned.

Domestic livestock production on which very high hopes have hitherto been set continuously fails to meet existing demands, to say nothing of its inability to cope with the ever-increasing pressures of human population growth. We are forced therefore to search for other sources of food to cover our nutritional and dietary requirements — any food — any sources — whether they be rodents, bats, anteaters, primates, birds, reptiles, even the larvae of the palm beetle or the African giant snail or wild ungulates. Finding and utilizing these protein purveyors alone are not enough for without rational exploitation we may consume them to their extinction. Systematic and scientific cultivation of a chosen species is therefore a necessity, in some cases a prerequisite, to the perpetuation of that species and ultimately to the perpetuation of our own. This systematic and scientific cultivation and the bringing of an animal into subjection and dependence on man for the definitive betterment of man are the intention of game farming.

Game animals have always been recognized as a source of food in Zambia; they have played an important role in the diets of the inhabitants of many villages. The meat of the black lechwe of Lake Bangweulu, for example, was utilized when a supply route ran through the area during the First World War and again as food for the construction gangs building the Copperbelt/Rhodesia Railway. But along with continuous and indiscriminate slaughter comes the decrease of chances of a successful hunt. Numbers of the black lechwe, for example, have shrunk from more than an estimated half million, as recently as fifty years ago, to an estimate of less than 30 000 today.

In addition to this the laws of the land tend to inhibit game hunting for meat. In any case, increasingly fewer people cover their nutritional requirements with game meat. This is especially so in Zambia: a large percentage of the population lives in urban areas.

These facts emphasize the importance of developing systems whereby compatible animals could be farmed profitably. The idea is not new. Proposals to try and domesticate indigenous wild ruminants were made as early as 1848 when Methuen discussed the prospects for both the buffalo and the eland. However, despite these early sentiments the only wild species present in southern Africa which has been domesticated in the strict sense of the world has been the ostrich and the only domesticated African mammal is the camel. This brings home the great length of time the process spans. For the purposes of game farming, total domestication of a species is not warranted, nor is it wholly desirable, since there exists the possibility of increased capitulation to environmental pressures that could accompany domestication. It is exactly the non-susceptibility upon which we wish to capitalize.

The following arguments tend to point out the advantages of using these species for game ranching.

Firstly, wild ungulates have optimally adapted themselves to their natural environment and therefore a more effective exploitation of existing vegetation, as well as the superior ability to cope with surrounding temperature, is possible. Some authors contend that the eland, for example, are better

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equipped to utilize arid and semi-arid ranges. There is also evidence that some ungulates graze or browse on plants and shrubs either not eaten (or not preferred) by domestic stock or eaten at different stages in the plants' growth cycle. Moreover, numerous physiological mechanisms exhibited by wild ungulates guarantee their survival in those marginal regions where intensive production of or even habitation by domestic livestock is impossible. For example, the reduction of faecal and renal water loss of some species coupled with an increased ingestion of liquid obtained from plants and shrubs is practically sufficient to make them independent of surface drinking water for longer periods of time, thus enabling them to traverse large tracts of land in search of food. Moreover, certain wild species exhibit behavioural peculiarities that enhance their survivability in hot arid regions.

Secondly, the efficiency of food utilization compares favourably with domestic livestock especially when related to the types of food ingested. It has been found that the protein intake of cattle at the end of the dry season was inadequate for maintenance whereas the eland grazing on the same veld still appeared to be thriving. Carcasses of wild ungulates contain a much higher percentage of lean meat than domestic ungulates while at the same time achieving the same dressing percentages as fat domestic stock. The dressing percentage on the whole has generally been confirmed as being higher (50-63 percent) than in Angoni or Barotse cattle (40-58 percent). The growth rate of certain species of antelope also compares promisingly with indigenous domestic livestock. Studies in the U.S.S.R. and Rhodesia on eland show that at three years of age the female reaches an average weight of 350 kg and the male just under 500 kg. This compares with 300 kg and 400 kg for a female and male Angoni animal of the same age respectively.

Even though milk production of antelope is of peripheral importance it may be noted that trials in the U.S.S.R. on the eland resulted in an average milk yield of 450.2 kg of milk per annum between the second and seventh lactations. Milk fat percentages from studies on the African eland ranged from 9.1 to 11.0 percent.

The third main concept for proposing the advantages in game farming lies in the decreased susceptibility and the superb adaptation of wild ungulates to disease. The buffalo, for example, is known to be extremely resistant to many of the cattle diseases, including trypanosomiasis, and antelopes can use tsetse bush without apparent ill effects. However, we must not lull ourselves into an attitude of complacency toward disease risks. On the other hand, it would be equally incorrect not to recognize the supreme advantages of antelope in the special local circumstances of Zambian range land. Even though there is enough literature to point out that wild ruminants have succumbed to foot-and-mouth disease, anthrax, rinderpest, and a host of other maladies, or were shown to have agglutination titres for antibodies to various pathogens, it is a fact that wild ungulates suffer far less from many of the specifically local diseases which make life hazardous for cattle under those conditions. The point, I feel, is not whether antelopes in general are disease-free but simply that cattle in certain areas suffer excessively. The diseases include not only such familiar ones as trypanosomiasis but also the equally important diseases of production induced by heat stress and water deprivation that manifest themselves in the form of reduced fertility and slower growth rate.

game farming should be complementary to — not competitive with — domestic livestock production

Fourthly, within the context of mankind's aesthetic values we owe it to posterity to preserve any threatened genera. Zoological gardens with their artificial surroundings, despite their initial successes in some isolated cases, are pathetically inadequate to guarantee reproductivity and ultimate survival. In truth, the appalling conditions found in many zoos may even hasten the demise of our fellow travellers on this our Spaceship Earth. Viewed in this light the conviction that profitability of such an enterprise must be our prime motive becomes dubious.

In all these considerations two factors must be constantly borne in mind: the need for research on prospective game animals; and the need for information relative to successful game farming. However, we are treading here on dangerously thin ice. The process of research in the field of wildlife is agonizingly slow and governments of developing nations are often unwilling to wait for long periods in order to have answers to pressing problems, especially when it necessitates perpetual, substantial monetary inputs. Moreover, experience shows us that when financial crises face developing nations the first cut-back is directed toward the allocation of funds for research work. Yet, for a novel plan such as game farming in Zambia, much information is needed, data that will decide not only the feasibility of such a scheme but also the long-term profitability. It is true that we may utilize results already compiled in this field by friendly and even antagonistic nations close to our borders. But all results will not be applicable to Zambia whose topography, climatology and sociology differ from those of our neighbours. We would first have to pinpoint these differences before developing a strategy of game farming research. Many questions will have to be answered, among them:

- Will the characteristic social organization of the proposed species be negatively influenced to the point of being harmful to the well-being of that species?
- What species can live best where?
- At what age should we slaughter?
- Are fattening and supplementary feeding economically viable?

ELAND AND DOMESTIC CATTLE RAISED TOGETHER IN ZAMBIA

why not?

- Can semen be collected, expanded and stored with the objective of inseminating females at a later date?
- Should we castrate male animals for the purpose of docility and possible improved weight gains?
- Can game animals be introduced on to cattle ranches with a view to increasing stocking rates?
- Can we influence times of calving and weaning?
- Disease control in domestic animals has been achieved and maintained in Zambia by quarantine, rotational grazing, dipping, oral dosing and immunization. Can the problems of handling and management of wild animals in relation to disease control be overcome by the same methods?

These are but a few of the many questions that will confront the research staff — and answers must be found. Research into problems must be increased and expanded so that we know the answers before the source of potential meat producers is extinguished forever by increasing human populations.

The need for having veterinarians and animal husbandmen on the research team must be emphasized. Without wishing to detract from the enormous contribution, real and potential, of field zoologists, it is a fact that, unlike the graduate in animal

production, they do not possess the required background in agriculture practice which, in essence, is what much of game farming is all about.

Game farming is a reality; it is a reality now. It is a means of producing more of a much needed commodity — meat.

It must be regarded as complementary (not competitive) to domestic livestock production. It must, therefore, receive progressive attention and must attract more detailed consideration in the formulation of future land-use plans. ■

Part of African culture

Mankoto Ma Mbaelele

Throughout Africa hunting for food constitutes the most extensive single form of wildlife utilization. It is carried out in a generally haphazard, uncoordinated way. In regions rich in wildlife where there are almost no other sources of animal proteins, the rational organization of a carefully studied hunting system could resolve, to a large extent, the problem of protein shortage.

This objective can be attained by adopting measures specifying the hunting zones, the species to be hunted and the hunting season by region and by species, based on biological and ecological knowledge of the species.

Game cropping is a controlled, but still extensive, method of wildlife utilization. One formula adopted in this type of utilization is to cull the annual surplus of animals in national parks and wildlife reserves — the culling being done only by responsible authorities. The meat is sold on the spot to the nearest dwellers. The bones are turned into fertilizer. The trophies and skins are auctioned off, usually to craftsmen who turn them into objets d'art or souvenirs for tourists.

Game farming or rational livestock raising is an intensive and artificial form of wildlife utilization resembling animal husbandry. It is concerned only with certain particularly profitable species and requires a certain degree of organization:

- Choice of wild animal species suitable for ranching. Elements to be taken into consideration are high rate of reproduction, precocity, meat yield, resistance to disease, behaviour under controlled conditions, ease of rearing, the quality of the product, etc.;
- Analysis of biophysical and socio-economic conditions leading to selection of a pilot zone suitable for experimentation;
- Preparation of infrastructure (accessibility, provison of water, construction of enclosures and buildings) and installation of animal husbandry and sanitary equipment, together with the equipment essential for the preparation and storage of the products;
- setting up of a collective facility for marketing of the products, social promotion of the project and the training of personnel;
- dissemination of knowledge on production, processing and marketing methods, together with provision for the information and participation of the local populations so that they can benefit from this applied research.

The indisputable usefulness of national parks is here clearly seen: on the one hand they make possible the basic ecological studies necessary for obtaining the best returns from the regions around them; and on the other they provide the livestock raisers with the animal breeds best adapted to these regions. Seen from this angle, national parks constitute real natural laboratories for scientific study and the advancement of knowledge.

In addition to its usefulness for nutritional purposes, wildlife plays a far from negligible role in the national economy of many African countries, through the sale of collector's items or through tourism: hunting tourism (search for trophies) or visual tourism ("collection" through observation). And we know that the "hidden" contribution of tourism to the balance of payments through the hard currencies it brings in can assume enormous proportions, as in the case of Kenya and Tanzania.

In order to reduce the dangers of this commercialized aspect of wildlife utilization, control is essential.

Wildlife utilization consists, for practical purposes, in reconciling man's recreational requirements with his nutritional requirements.

African wildlife could thus constitute a powerful natural factor in development. Yet the food potential of certain animal species — in Zaire, for example — is far from being exploited in a rational manner. Research aimed at making the best use of this potential could therefore help to solve the particularly acute problem of malnutrition.

The rational organization and utilization of "domestic game" would be of benefit, above all, to those living in rural areas, among whom many cases of protein deficiency are found, and who are usually exploited by urban profiteers.

This type of research is also justified by the fact that no work in this field is being carried out in Zaire, any more than in the other French-speaking African countries.

Encouraging progress has been made in experimental farms in South Africa, Rhodesia, Zambia and Kenya. In Zaire, projects are under study for the rational utilization of wildlife through organized hunting activities in the immense hunting reserve of Bili-Uere. Much of the basic infrastructure for this reserve has already been installed thanks to a Zaire/UNDP/FAO project. Wildlife inventories have been carried out and show

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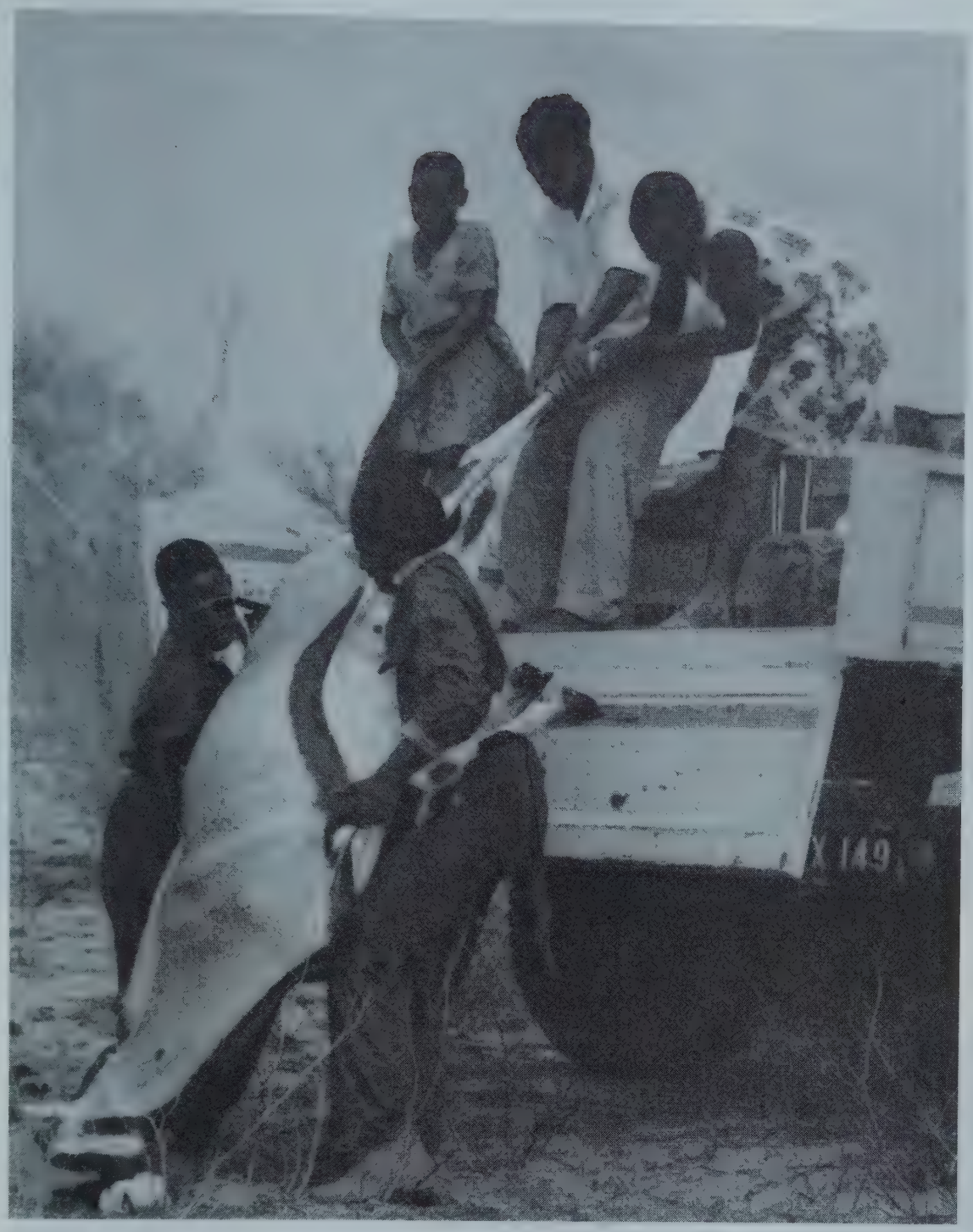

A GEMSBOK CARCASS BEING LOADED INTO A TRUCK IN BOTSWANA
where game is the main source of protein

the presence of abundant and varied wildlife. At a later stage it might be possible to undertake rational ranching of the large Derby eland, an antelope characteristic of this reserve.

A further justification for wildlife utilization is of a biological and ecological nature. In this respect wildlife offers a number of advantages as compared with domestic livestock. Studies have shown that the biomass per hectare is much greater with wild ungulates than with domestic animals under extensive stock-raising systems.

According to Alain Monfort, in the Sudanese-Zambesian savannas of east Africa the biomasses of wild ungulates are fairly stable and lie between 6 and 8 tons/km², while in the same phytogeographic field charges of barely 2.3 tons/km² are obtained with traditional domestic livestock and an average of 4.6 tons/km² in the managed ranches.

The reason for this difference is that the wild herbivores make better use of their habitat than do the domestic livestock, by utilizing fully all the food resources of the savanna. One may observe, for instance, that each one of several species feeds on a different part of the shrubs and explores different vegetative levels, thus avoiding considerable wastage of the nutritional possibilities of the environment. This is not the case with domestic cattle, which browse only on certain grasses, ignoring those for which they have no liking.

The big antelopes are infinitely better adapted to the African biotope. As a result of natural selection over a very long period of time, they are usually very resistant to diseases and withstand droughts better. Even if they cannot find anything to drink the oryx, for example, manage to keep their weight.

Moreover, practical trials have shown that the large elands such as the oryx become as docile as cattle provided they are captured young and raised on the bottle. Africa's big fauna, through the play of death and birth, constitute a renewable natural resource that can be easily utilized, provided no inroads are made on its capital. Despite the massacres which have taken place, certain countries of Black Africa, including Zaire, still possess considerable wildlife potentials.

The fairly diversified network of national parks and associated reserves already in existence in Africa could provide the animal surplus needed for carrying out original trials on the raising of animals better adapted to our conditions. This would constitute a real " recourse to African authenticity ".

The need is already being felt in the Sahelian countries, where the Sahara is steadily advancing, taking over the poor savanna. This means that a plan of control should be established without further delay, and new methods of cultivation and also of livestock raising should be adopted immediately, capable of guaranteeing higher food resources with species better able to withstand natural calamities (drought, famines).

But this does not mean, of course, that wildlife can resolve all the world's troubles. Wildlife is only one alternative among many others, and represents primarily a solution for the benefit of rural populations.

It is through wildlife management that we begin to see how African countries can find reasonable and inexpensive solutions in their search for ways and means to solve the problem of hunger and provide food for their peoples. ■

Both beautiful and useful

Photographs
by Norman Myers

Beautiful and romantic sights to non-Africans. To Africans they are both beautiful and useful.

Wildebeest (above) are more disease-resistant and more fecund than cattle.

Eland (left) also thrive on arid land unsuitable for cattle and have been successfully ranched alone or with cattle in Kenya, Rhodesia, South Africa, Tanzania and Zambia.

The Gerenuk or Waller's gazelle (right) is at home in the desert; normally it does not drink at all, taking its moisture from dry-looking vegetation.

Grant's gazelle (left) is bigger than Thomson's gazelle (right) and gives a higher percentage of meat when dressed, about 63% compared to 57%. The Thomson's gazelle, however, has been managed experimentally in Kenya as a semi-domesticated animal.

Wildebeest (below left) weigh an average 240 kg for males and 190 kg for females, of which 56% is meat after dressing.

Hippopotamus and buffalo (below right) are among the heavy-weights. Mean weight for hippos: 2 500 kg for males and 2 100 for females. In addition to meat and lard, their hide is valuable for leather. Buffaloes — average males 750 kg, females 600 kg — have good quality meat and can be as docile when domesticated as they are irascible when wild.

Eland, buffalo and hippopotamus range across Africa south of the Sahara. Wildebeest are found in eastern and southern Africa and Thomson's, Grant's and Waller's gazelles live in eastern Africa. None of these animals are becoming extinct and management practices have been developed for all of them.

Competitive uses of wildlife

A Cameroon wildlife officer tells how policy is turned into practical management

Victor S. Balinga

In developing countries in particular wildlife may have to serve a number of needs, some of which may be in competition with each other. This article deals with how the Government of Cameroon comes to terms with these problems.

Cameroon tries to base its wildlife policies and management practices on three realities:

— Game is an important source of protein and a preferred traditional food much in demand.

— Wildlife also means tourism and sport hunting under safari arrangements, especially from December to April. Therefore, it represents a significant income in foreign exchange.

— Wildlife has to be perpetuated as an important part of the national heritage. The Government has delineated five national parks in the northern part of the country with a total area of 580 000 hectares.

Conservation education in Cameroon has now begun but it is still in its infancy. In what was formerly East Cameroon, the Government started setting up game reserves in 1950: Waza, Kalamaloue, Benue, Faro, Dja, Douala-Edea, Campo, Pangar Djerem (a closed area) and others cover altogether about two million hectares. In former West Cameroon, the first reserve — Kimbi River Game Reserve — was created in 1963, followed by the Mbi Crater Game Reserve, with a total of some 5 000 hectares.

Some people question why these areas are protected; clearly they are still not well enough informed to judge the importance of having conservation areas.

Today more than ever before, the change from purely traditional subsistence hunting to organized sport and commercial hunting with sophisticated guns and transport calls for urgent programmes to inform people about the need to manage and conserve our wildlife heritage. This is preoccupying the minds of policy-makers, and the Government is contemplating a number of action programmes of information and education.

Director Andrew Allo Allo of the Wildlife College at Garoua has, for instance, formed wildlife clubs in the north, mainly consisting of schoolchildren and has enrolled a total of 400 in Maroua, Mokolo and Garoua. The college staff are sent out from time to time to talk to them and show slides and films. Excursions into the bush to view animals and to appreciate the way various elements in an ecosystem depend upon each other have also been undertaken. It is hoped that these activities will gain popularity and spread, especially in the south of the country, where the wildlife environment needs to be well managed.

The Agriculture Ministry's Information Service has given radio talks on wildlife conservation and has plans to operate mobile units which will go to remote villages with slides and films. Under the auspices of the African Wildlife Leadership Foundation there are plans to assist the Government with a conservation education programme similar to that in Botswana. They also plan to provide technical advice, staff and equipment to the Wildlife College at Garoua which serves all of west Africa as a training centre in this field.

In Cameroon, as in most of west and central Africa, wildlife is by tradition regarded as a regular and God-given source of protein. Our people believe that hunting should be free and cannot understand why they should be restricted in this activity. After all, they have always hunted since the time of our forefathers. It should not be surprising, therefore, that despite legislative measures, poaching has been the order of the day for years and is entrenched among the habits of the people.

Past and present wildlife legislation has recognized that hunting is deeply rooted in the culture. This is true for the whole of the south and for a part of the north of the country. Consequently, legal provision has been made for traditional hunting without permits. This authorizes hunting and trapping with weapons and devices

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made from traditional materials and the use of spears, bows and arrows, and dogs. Guns, however, require a permit.

In the north, there are cattle and this is the main source of protein. But in the south forest, only the dwarf cow exists, particularly among the Bakweris of Fako and the Bakossis of Meme, and the major protein source is local wildlife, together with cattle brought in from the north.

There are also certain depressed areas of the country where hunting provides virtually the only means of living, as in the regions of Akwaya, Ndian, Nkam and Mouloundou. In these areas, cattle from the north are rarely seen, there are no farms, and the people hunt to feed themselves, selling or trading some game meat for the other necessities of life. In many parts of the east, and particularly from Lomie to Mouloundou, there are pygmies whose sole way of life is hunting. They are never at any time expected by the Government to take out permits and are allowed to hunt freely in all seasons of the year.

But the law also provides for strictly regulated hunting for which hunters are expected to possess permits costing from 10 000 to 20 000 Cameroon francs for residents and from 20 000 to 40 000 francs for non-residents. With the Cameroon franc at 278 to the U.S. dollar this comes to the equivalent of $36 to $72 for residents and $72 to $143 for non-residents. Under former regulations, sport hunters were not allowed to sell game meat. They usually gave it to the local population for food and the villagers usually consumed what they could and sold the rest. Recent legislation has now made

FOREST SERVICE STAFI AND VILLAGERS WITH CARCASS OF ELEPHANT THAT THREATENED A VILLAGI
". . . a God-given source of protein"

it permissible for hunters to sell their meat. In some instances under the former regulations when meat was given away, some meat was never used and went rotten and it is hoped that the new legislation will discourage this.

Under other regulatory provisions, game controls are authorized by the Forestry Department and game guards may be sent to kill marauding animals. First, however, it has to be well established that there was actual game damage to crops and property before control operations are carried out. The former West Cameroon forestry law provided for the cheap sale of meat resulting from such missions to the local people and a tradition developed whereby about half of the meat of marauding animals was given free to the people who had suffered damage while the other half was sold locally by the Government. Such activities can make a significant contribution in protein for village populations.

There have, of course, been instances when villages, in their desire to have game meat, would raise false alarms of crop destruction just to cause game guards to kill animals for them. It shows, in any event, how important game meat is for the diet of our people.

In the former East Cameroon, meat of animals killed by game guards was left entirely without charge for those who had suffered damage. If there were no government game guards, licensed hunters were usually asked to kill the animals and were compensated with either the meat or the trophy, or, as was the case in the former West Cameroon, by a bounty of up to 7 000 francs ($25) in cash.

Apart from legal hunting, there is today widespread hunting by poachers. Furthermore, poachers will also use outlawed devices and methods, from unauthorized firearms to traps which may endanger human lives. The amount of poaching is high as a result of the limited number of control staff and the limited resources at their disposal. The Government is aware of the problems facing those charged with controlling poaching and is doing everything it can to help them.

Some poaching is done only for meat but there are also poachers who operate commercially. Game animal products sold for cash include cuts of meat, as well as trophies such as skins and tusks.

Whatever the basic objective, almost all of the meat from poaching activities is consumed locally. Market sheds are known to be full of game meat; traders will sometimes hide the meat under some other produce such as fish which is widely sold. Night poaching is often practised as a more secure means of avoiding the police. Game restaurants in Cameroon are well patronized and the meat is very expensive. There are certain stops along the main roads where restaurants specializing in game meat do thriving business.

Most of the poachers in the field are not operating strictly on their own account. Persons who may not know how to use guns skilfully, or may have no time to hunt, will buy arms and ammunition and give them to talented hunters who poach for them. This results in a particularly serious threat to elephants which are illegally hunted for their tusks. Pygmies, because of their privileged position under the law, are sometimes recruited as poachers and paid a pittance for their work in the form of tobacco and other inexpensive items.

There are certain main roads which go though national parks, such as the Kalamaloue National Park, and lorry drivers on long-distance routes between Nigeria and Chad will time their journey in order to arrive at these conservation areas at night, spend some time in illegal hunting and, before morning, be off with their vehicles loaded with meat.

Other poaching problems involve game reserves under timber exploitation permits, such as Campo Game Reserve. Forest workers in such remote areas, finding themselves without beef, think nothing of killing wildlife while they are on the job in order to enrich their diets. Many animals can be lost that way.

National borders are also frequently crossed by professional poachers. On a number of occasions, groups from neighbouring countries enter national parks to hunt and shooting has occurred in which poachers were seriously wounded or killed.

Hunting permit holders receive quo-

Game animals commonly used for food

FOUND IN SAVANNA LANDS:

Cheetah (*Acinonyx jubatus*)
Rhinoceros (*Diceros bicornis*)
Giraffe (*Giraffa camelopardalis*)
Warthog (*Phacochoerus aethiopicus*)
Giant eland (*Taurotragus derbianus*)
Roan antelope (*Hippotragus equinus*)
Buffon kob (*Kobus kob*)
Hartebeest (*Alcelaphus buselaphus*)
Topi (*Damaliscus lunatus*)
Gazelle (*Gazella* sp.)
Patus monkey (*Erythrocebus patas*)

FOUND IN SAVANNA LANDS AND FORESTS:

Baboon (*Papio* sp.)
Lion (*Panthera leo*)
Leopard (*Panthera pardus*)
Hippopotamus (*Hippopotamus amphibius*)
Sitatunga (*Tragelaphus spekii*)
Bushbuck (*Tragelaphus scriptus*)
Buffalo (*Syncerus caffer*)
Elephant (*Loxodonta africana*)
Hyena (*Crocuta crocuta*)
Serval cat (*Felis serval*)
Civet cat (*Civettictis civetta*)
Reedbuck (*Redunca redunca*)
Duiker (*Cephalophus* sp. and *Sylvicapra*)
Aardvark (*Orycteropus afer*)
Waterbuck (*Kobus ellipsiprymnus* and *K. defassa*)
Oribi (*Ourebia ourebia*)
Tantalus monkey (*Cercopithecus aethiops*)
Crocodile (*Crocodylus* sp.)

FOUND IN FORESTS:

Chimpanzee (*Pan troglodytes*)
Mangabey (*Cercocebus* sp.)
Gorilla (*Gorilla gorilla*)
Colobus monkey (*Colobus* sp.)
Drill (*Mandrillus leucophaeus*)
Mandrill (*Mandrillus mormon*)
Bush pig (*Potamochoerus porcus*)
Bongo (*Boocercus eurycerus*)
Porcupine (*Hystrix* sp.)

tas of ammunition from the administrative authorities, but because of the great demand for bush or game meat in some areas, such quotas usually have not been enough. Villagers have tried to fool the authorities by asking for ammunition for traditional ceremonies in order to use it for hunting. Even when such requests were genuine, ammunition left over after the celebrations has ended up being used for hunting.

There are also annual hunting parties in areas especially set aside at villages or in a chief's own hunting grounds. On such occasions, the villagers will furnish themselves with large quantities of bush meat.

Control of legal and illegal hunting in Cameroon is not a sophisticated affair as in many developed countries. The authorities concentrate on doing their best to discourage poaching but they do not engage in gathering statistics on the wildlife situation. Consequently, it has not been possible to evaluate the amount of game meat consumed in the country, nor would this be an easy task. Attempts to distribute questionnaires about fisheries, for instance, have met with a negative reaction. According to the Veterinary Department's data on cattle consumption in the whole of north Cameroon, about 9 640 tons are consumed annually. The only study on game meat was done by Dr. J. Esser of the Garoua Wildlife College on animals killed mainly by tourist hunters. It indicated that the total weight of all species taken in north Cameroon in 1973-74 was 514 tons. It has to be appreciated that this is a zone where poaching is not intense and the residents depend more upon cattle for their meat supply.

Considering that in many parts of the south people depend entirely on game meat, it may, therefore, be estimated that at least 2 000 tons of game meat are consumed in the country annually. On the basis of casual observations in trains from the Lom and Djerem and the Upper Sanaga, at railway stations, in vehicles from Yoko to Yaoundé, on markets in southern towns, the regular supply of game meat to private customers and to restaurants, and taking into consideration Dr. Esser's study, it would not be out of line to estimate that the consumption of meat is 90 percent cattle and 10 percent game meat in the north, and 70 percent cattle and 30 percent game meat for the whole country.

ANATOMY CLASS, COLLEGE OF AFRICAN WILDLIFE MANAGEMENT, TANZANIA
training wildlife officers for all of Africa

As we have said most Cameroonians have a taste for game meat and prefer it to meat of domestic animals. But there are also other reasons for hunting wildlife, such as procuring parts or specific organs of certain species for medicinal or ritual uses. The bones of certain primates and the fat of pythons fall into this category of use. Furthermore, during certain ceremonies or holidays, game meat may be indispensable to the menu in order to give the occasion the traditional respect it deserves. This, of course, is no different from any culture in the world where certain feasts are not feasts without the appropriate traditional dishes.

All of which merely shows that the demand for game meat in this part of Africa is very high, and, as we pointed out at the start, the realities which the authorities have to deal with in wildlife management are inherently in conflict to one degree or another. What we know we have to do is to utilize our wildlife for the good of the people while, at the same time, using it in such a way as to maintain it as an essential part of our culture. Management, utilization and conservation combined is our approach and goal. ■

Trends in international environment law

It is growing; there are more than 40 global and regional conventions on resources management and conservation

Peter Sand

Environmental problems are not caused by natural or technological factors alone, but may be generated or aggravated by socio-economic factors. A well-known example is land degradation and desertification, where inadequate patterns of land and water management are often closely tied to the underlying legal structure of ownership and rights of use. Overintensive farming, for instance, may partly be a result of excessive fragmentation of holdings, due to existing land tenure and succession laws. Overgrazing may stem from traditional rights of land use insufficiently adapted to changing economic and demographic circumstances. The mutual legal claims of upstream and downstream water users, whether based on contiguity or acquired rights of use, may prevent optimal development of shared water resources. Similarly, the historical legal regime of the oceans raised the danger of overexploitation of common marine resources.

Usable instruments

"Outdated" legal structures may thus act as constraints on the rational management of resources — though not necessarily so: many countries have begun to re-discover the advantages of adapting existing legal instruments to the new requirements of resource conservation and environmental protection; examples are the discharge permits required pursuant to the 1899 U.S. Refuse Act or the remedies for neighbourhood nuisances (troubles de voisinage) available under nineteenth century European civil codes, both of which have been turned into useful instruments of pollution control today.

The very multitude and diversity of laws applicable to natural resources and environmental matters, and the ensuing risk of overlapping or contradictory regulations on competences, have been recognized as a problem in most countries. While the need for coordination and administrative reorganization in this field is urgent, new integrated legislation should not be considered as a panacea. The effectiveness of modern environmental law depends to a large extent on sound "sectoral" legislation and administration for specific resources in such traditional fields as land and water law; forestry, fisheries and wildlife legislation; health and food regulation.[1]

Legislative shortcomings

One of the shortcomings of past legislation for the conservation and protection of natural resources has been its predominantly negative and punitive approach. While legal restrictions are necessary to avoid overexploitation and interference by incompatible activities, legislation should do more than just prohibit pollution, hunting, or timber-felling. The need to combine sanctions with positive incentives to implement policy objectives, and the need to provide a legal basis for resource planning and management, arise both at the national and the international level. For example, the 200-mile extension of national juris-

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diction over living marine resources, which is emerging from the Third U.N. Conference on the Law of the Sea, involves increased management responsibilities for coastal states and creates a need for review and harmonization of legal regimes and institutions.[2]

There is a close interrelation between national and international aspects also as regards the effects of legal rules on international trade. Strict environmental controls unilaterally applied to certain commodities and products in one country may seriously affect imports from other countries. In order to reconcile conflicting national laws and standards in this field, international efforts at harmonization are required, along the lines of the work already undertaken by the Joint FAO/WHO Codex Alimentarius Commission.[3]

As different countries share common problems of resource management and environment protection, they can share the experience acquired in coping with these problems and endeavour to develop mutually acceptable solutions. International exchange of information for this purpose includes legal data exchange. Several U.N. specialized agencies have for many years disseminated information on the current legislation of their Member States in such environment-related fields as health law (WHO *International Digest of Health Legislation*), and renewable natural resources law (FAO *Food and Agricultural Legislation* series). The principal aim of these information services is to bring innovative recent developments in national legislation to the attention of other interested countries, thereby facilitating also ongoing technical assistance activities. In 1976, FAO and UNEP initiated a joint experimental project for the cataloguing of such environmentally relevant legislative data by computer.[4]

A significant trend in both national and international law-making in this field has been the broadening scope of legal rules, from a " use-oriented " to a " resource-oriented " perspective.[5] Some countries have attempted comprehensive codification of all rules relating to renewable natural resources and environment protection, in a single " environment code ".[6] Others, while retaining separate legal instruments for different categories of resources, have introduced substantive reforms, with a change in emphasis from the police functions to the management functions of the law and to new incentives for compliance;[7] from classical nature protection to natural resources conservation;[8] from water and air pollution controls to general anti-pollution acts;[9] from provisions for specific dangerous chemicals such as pesticides to the regulation of all potentially harmful substances;[10] and

GIRAFFE AND ZEBRA IN EAST AFRICA
environment law needs to be considered sectorally

from laws protecting specific species of animals and plants to trade controls over primary and secondary products derived from them.[11]

At the same time, besides re-allocating administrative competences between existing and new institutions, a growing number of countries have enacted "framework legislation" laying down general policies and procedures for environemental management, including citizen participation in decision-making.[12] The regulatory systems developed for this purpose usually require either special licences,[13] or environmental impact statements,[14] for all activities involving potential environmental risks. At the international level, a combination of legal restrictions with compulsory licensing and joint technical measures has been developed, e.g., for the control of waste dumping in ocean and inland waters.[15] There also is a common tendency to establish — by law, and in some cases by international agreements — functional administrative units for ecological areas which are either particularly suitable for resource management (e.g., self-governing water basin authorities) or are particularly endangered (e.g., nature reserves and parks).

There now are more than 40 multilateral conventions dealing with natural resources management and conservation, especially of the marine environment. While a number of these treaties are global in scope (possibly culminating in a future convention on the law of the sea), the main advances in recent years have been made at the regional level. In particular, a number of new legal instruments were created, and existing agreements revised, for the joint management of inland water resources[16] and ocean fisheries[17] and for environment protection in special marine regions such as the Baltic, the Mediterranean and the Red Sea.[18] Together with bilateral agreements on shared resources and transfrontier pollution, and with related declarations, recommendations and standard-setting activities of several international and regional organizations, these instruments may be considered as part of the growing body of international environmental law.[19] Besides serving as secretariat for several of the institutions concerned, FAO has contributed to the development of new methodological approaches in this field by way of information exchange, legal drafting assistance, and through the organization of expert meetings and intergovernmental conferences.[20] ■

Notes

[1] E.g., see the following studies: Mifsud, F.M., "Customary Land Law in Africa", *FAO Legislative Series No. 7* (1967); FAO/WHO Guidelines for Legislation concerning the Registration for Sale and Marketing of Pesticides (1970); Kropp, G., "Wildlife and National Parks Legislation in Asia", *FAO Legislative Study No. 2* (1971); Christy, L.C., "Legislative Principles of Soil Conservation", *FAO Soils Bulletin No. 15* (1971); Caponera, D.A., "Water Laws in Moslem Countries", *FAO Irrigation and Drainage Paper No. 20/1* (2nd ed. 1973); Moore, G.K., "The Role of Administrative Action as a Tool in Water Pollution Control", *FAO/EIFAC Technical Paper No. 18* (1973); Savini, M.J., "Report on International and National Legislation for the Conservation of Marine Mammals", Part I: *FAO Fisheries Circular No. 326* (1974); Gerard, A., "An Outline of Food Law: Structures, Principles, Main Provisions", *FAO Legislative Study No. 7* (1975); Prats-Llaurado J. & Speidel G., *Estudio comparado de las administraciones forestales públicas de América Latina*, FO: MISC/75/22 (1975); Moses, W.R. & Henderson, J.J., "Guidelines for Developing an Effective National Food Control System", *FAO/WHO Food Control Series No. 1* (1976).

[2] See "Limits and Status of the Territorial Sea, Exclusive Fishing Zones, Fishery Conservation Zones and the Continental Shelf", *FAO Fisheries Circular No. 127* (Rev. 2, 1975); and the reports of the FAO/SCSP Workshop on the Legal and Institutional Aspects of Fishery Resources Management and Development (Manila, April 1977), and of the FAO/CIDA Seminar on the Changing Law of the Sea and the Fisheries of West Africa (Banjul, September 1977).

[3] See Dobbert, J.P. "Le Codex Alimentarius: vers une nouvelle méthode de réglementation internationale", *Annuaire français de droit international*, vol. 15 (1969), p. 677; and the *List of Standards, Codes of Practice and other Documents already adopted by the Codex Alimentarius Commission and those under elaboration*, CX/GEN-75/1 (1975).

[4] See the Summary Report, *Catalogue of Legislation on Environment and Natural Resources*, FAO/UNEP Joint Project No. FP/1302-75-02 (1977).

[5] E.g., further to the references in footnote 1 above, see Sandoval, M.T., "Legislación de Aguas en América Central, Caribe y México", *FAO Legislative Study No. 8* (1975); "Water Law in Selected European Countries", Vol. I, *FAO Legislative Study No. 10* (1975).

[6] E.g., the 1974 Colombian Code of Renewable Natural Resources and Environment Protection, drafted with FAO/UNDP assistance; see Cano, G.J., "A Legal and Institutional Framework for Natural Resources Management", *FAO Legislative Study No. 9* (1975).

[7] E.g., see the 1976 U.S. Fishery Management and Conservation Act; the 1976 U.K. Fishery Limits Act; and the 1976 Decree on Provisional Measures to Conserve Living Resources and Regulate Fishing in the Sea Areas Adjacent to the Coast of the U.S.S.R. On incentives in forestry legislation see Bombín, L.M., *Incentivos económicos forestales en América Latina*, FO:MAFP/LA/75/4 (1975).

[8] E.g., the 1970 Natural Resources Conservation Act of Zambia.

[9] E.g., the 1971 Mexican Federal Act for the Prevention and Control of Environmental Pollution; and the 1974 German Federal Act on Protection from Environmental Nuisances.

[10] E.g., the 1973 Swedish Act on Products Hazardous to Man or the Environment; and the 1975 Canadian Environmental Contaminants Act.

[11] E.g., under the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora. A similar trend appears in the proposed 1976 amendments to the 1951 International Plant Protection Convention, and in recent national legislation such as the 1975 Trinidad and Tobago Plant Protection Act.

[12] See the surveys by Sand, P.H., "Legal Systems for Environment Protection: Japan, Sweden, United States", *FAO Legislative Study No. 4* (1972); and Lutz, R.E., "The Laws of Environmental Management: A Comparative Study", *American Journal of Comparative Law*, Vol. 24 (1976), p. 447.

[13] Procedure developed under the 1969 Swedish Environment Protection Act, and subsequently adopted, e.g., in the 1973 Danish Environment Protection Act, and the 1974 Malaysian Environmental Quality Act.

[14] Procedure developed under the 1970 U.S. National Environmental Policy Act, and subsequently adopted, e.g. in the 1974 Australian Environment Protection (Impact of Proposals) Act, and in the 1976 French Nature Protection Act and Philippines Env. Pol. Decree.

[15] See the so-called "black lists" and "grey lists" annexed to the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, or the 1976 Bonn Convention on the Protection of the Rhine against Chemical Pollution.

[16] See the report on "Management of International Water Resources: Institutional and Legal Aspects", *U.N. Natural Resources/Water Series No. 1* (1975).

[17] See generally the "Report on FAO, the FAO Committee on Fisheries and International and Regional Fishery Bodies", *FAO Fisheries Circular No. 331* (1975); and particularly the 1976 statutory amendments of the General Fisheries Council for the Mediterranean and the Indo-Pacific Fisheries Council.

[18] E.g., the 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution; see "Protection of the Marine Environment against Pollution in the Mediterranean", *FAO Fisheries Report No. 148* (1974).

[19] See Kiss, A.C. "Survey of Current Developments in International Environmental Law", *IUCN Environmental Policy and Law Paper No. 10* (1976).

[20] FAO activities in environmental law are reported annually in the U.N. Juridical Yearbook, see vol. 1972, p. 61; 1973, p. 51; 1974, p. 67; 1975, p. 68.

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Improved utilization of tropical forests subject of meeting at Madison laboratory

Dr. K.F.S. King, Assistant Director-General of the Forestry Department, FAO, will keynote the International Conference, "Improved Utilization of Tropical Forests," which will be held in Madison, Wisconsin (U.S.A.), 21-26 May 1978.

Dr. King's address on the implications of research and the use of tropical forests on the world community will lead off the eight sessions now planned. The sessions include an opening general introduction to the tropical forest resource and closing summation of technical papers; two sessions on silviculture, harvesting, and the environment; two sessions on tropical wood products research; and two sessions on industrial practice and investment considerations.

The two sessions on research will encompass a wide variety of fibre products and deal with the experiences of the United Kingdom's Tropical Products Institute, France's Centre technique forestier tropical, the Pulp and Paper Research Institute of Canada, the Commonwealth Scientific and Industrial Research Organization, the University of the Philippines and the U.S. Forest Products Laboratory work as part of the U.S. Agency for International Development Study.

The last two technical sessions will cover industrial practice in all three major tropical areas — Africa, South America, and southeast Asia. Detailed investment considerations including a preliminary industrial survey for market pulp mills and an analysis of problems in process chemical production in developing countries will be presented.

All topics will get both a broad, global overview, as in some of the papers by FAO representatives, and a more detailed treatment in the technical papers presented by industrial and laboratory representatives.

A tour of the Forest Products Laboratory has been scheduled for a special session before presentation of the research papers.

Although almost all topics for the conference are now set, organizers will consider papers to be given by title and included in the officially published Conference Papers. These papers can also be discussed in the informal evening sessions.

A brochure, containing the agenda and registration information, is available upon request. Registration fee, which will be $95 per registrant, will provide a copy of the Conference Papers, four luncheons, conference dinner, and reception.

Further information on the conference can be obtained from: Tropical Hardwoods Programme Manager, USDA, Forest Service, Forest Products Laboratory, P.O. Box 5130, Madison, Wisconsin 53705, U.S.A.; phone: (608) 257-2211.

Programme

Sunday, 21 May, evening - Reception

Monday, 22 May, morning - Keynote address by K.F.S. King, FAO

I Tropical forest resource

Quantity and quality of the Tropical Forest Resource - S. Pringle, FAO

Anatomical characteristics of tropical woods - R. Koeppen, FPL

Monday, 22 May, afternoon

II Environment and silviculture

Environmental values of tropical forests - D. Poore, IUCN

Environmental impact of more complete utilization of tropical forests - J. Ewel, University of Florida

Forests and the Faustian Bargain - S. Richardson, Asian Development Bank

Silviculture: natural and artificial regeneration of forests and plantations - Nasipit Lumber Co.

Status of forestry in Ghana - F. Addo-Ashong, Forest Products Research Institute, Ghana

(Additional papers on environment and silviculture will be discussed in the evening session. Other evening sessions will be arranged as needed.)

III Harvesting, transport and storage

Logging experience in southeast Asia - Weyerhäuser

Implications of logging systems for more complete utilization - H.C. Mason, Inc.

Logging and chipping experience in Papua New Guinea - JANT

Outside chip storage in the Philippines - P. Bagawan, FORPRIDECOM

Tuesday, 23 May, afternoon

IV Wood fibre and product research

Suitability of tropical forests for pulpwood, mixed hardwoods, residues and plantation species - F. Phillips, CSIRO

Suitability of fast-growing hardwoods and long-fibred species for various products - C. Lantican, UPLB

Pulping of Ivory Coast hardwoods - G. Kubes, PPRIC

Suitability of fast-growing plantation hardwoods for pulp and paper production - J. Semana, FORPRIDECOM

Wednesday, 24 May, morning

V Wood fibre and product research

Pulp, papers and paperboards from mixed tropical hardwoods - J. Laundrie, FPL

Hardboards from mixed tropical hardwoods - G. Myers, FPL

Particle boards from mixed tropical hardwoods - R. Gertjejansen, University of Minnesota

Wednesday, 24 May, afternoon

Tour of Forest Products Laboratory; Conference Dinner

Thursday, 25 May, morning

VI Industrial plans and practice

Practical experiences in pulping mixed tropical hardwoods - J. Cubillos, Carton de Colombia

Integrated utilization of mixed tropical hardwoods - P. Picornell, PICOP

Utilization of tropical forests for the manufacture of pulp and paper - G. Petroff, CTFT

Utilization of bleached sulphate tropical hardwood pulp - R. Staepelaere, Parsons and Whittemore

Thursday, 25 May, afternoon

VII Investment considerations

General economic and political environment for investing

Problems in process chemical production in developing countries - H. Murray, University of Indiana

Preliminary industrial survey - R. Zabe, C.T. Main, Inc.

Government policies and regulations with impact on the development of forest products industries - T. Ellis, FPL

Friday, 26 May, morning

VIII Summations

Sessions I, II and III - F. Wadsworth, ITF

Sessions IV and V - J. Bene, IDRC, Canada

Sessions VI and VII - R. Eklund, Jaakko Pöyry

GUIDELINES FOR AUTHORS OF PAPERS

8th World Forestry Congress
Djakarta, Indonesia, 16-28 October 1978

Theme and scope of Congress

The theme of the 8th World Forestry Congress is Forests for People and it will be developed in five major discussion areas: Forestry for Rural Communities (FRC), Forestry for Food (FFF), Forestry for Employment Promotion (FEP), Forestry for Industrial Development (FID), and Forestry for Quality of Life (FQL). A total of topics for the five areas have been singled out provisionally, as shown in Appendix 1, which was published in Unasylva No. 115.

Papers (there will be four different categories of papers)

Position papers

A position paper is intended to provide an authoritative statement of world-wide significance, on the whole of one of the 30 selected topics on the Congress agenda, including relevant material from the other categories of papers. Position papers will serve as a basis for discussion at the Congress. After the Congress, they will be revised by the author — if need be — in the light of the discussion that will have been held during the Congress, for inclusion in the official proceedings of the Congress.

A position paper should have between 5 000 and 10 000 words, including the author's summary of not more than 500 words in the same language as the paper. It should be submitted in one of the three official languages of the Congress, i.e., in English, French or Spanish. A brief table of contents should be prepared. The table of contents and the summary should be on separate pages and should precede the main paper. Each position paper will be translated in full into the two other official languages of the Congress.

Invitations for the submission of position papers will be issued by the Chairman of the Organizing Committee.

Special papers

Special papers are intended to provide an authoritative detailed account of part of one of the 30 selected topics on the Congress agenda. Special papers, therefore, will be more restricted in coverage than will position papers, but their treatment of the subject is expected to be deeper.

A special paper should have between 2 500 and 5 000 words, including the author's summary of not more than 300 words in the same language as the paper. It should be submitted in one of the three official languages of the Congress, i.e., in English, French or Spanish. A brief table of contents should be prepared. The table of contents and the summary should be on separate pages and should precede the main paper. Special papers will be printed in full in the original language only, but the summaries will be printed in the three official languages of the Congress.

Invitations for the submission of special papers will be issued by the Associate Secretary-General of the Congress, on behalf of the Organizing Committee.

Voluntary papers

Voluntary papers need not deal with part of one of the 30 selected topics on the Congress agenda, but must only be related directly, or even indirectly, to one of the 30 selected topics.

Voluntary papers should be in one of the three official languages of the Congress, i.e., in English, French, or Spanish. They should be less than 2 500 words in length, including the author's summary of about 200 words in the same language as the paper. A brief table of contents should be prepared. The table of contents and the summary should be on separate pages and should precede the main paper. Voluntary papers will be printed in full in the original language only, but the summaries will be printed in the three official languages of the Congress.

Invited IUFRO papers

Contrary to the other three categories of papers mentioned above, each of which is intended to deal with no more than one topic on the Congress agenda, or with only one part of it, invited IUFRO papers will single out and elaborate upon the research aspects which are proper to the group of topics in each major discussion area.

Invitations for the submission of IUFRO papers will be issued by the Associate Secretary-General of the Congress, on behalf of the Organizing Committee and at the suggestion of the IUFRO Divisional Coordinator concerned.

An invited IUFRO paper should have about 5 000 words and a summary of 300-500 words in the same language as the paper. It should be submitted in one of the three official languages of the Congress, i.e., in English, French, or Spanish. A brief table of contents should be prepared. The table of contents and the summary should be on separate pages and should precede the main paper. Invited IUFRO papers will be printed in full in the original language only, but the summaries will be printed in the three official languages of the Congress.

Format for papers

Typing

Papers will be reproduced directly from the original manuscript by an offset process and, therefore, must be presented in standardized format. The manuscript should be typed on heavy

bond paper of approximately this size with a margin of 2 cm all round. The text should be single spaced with double spacing between the paragraphs. Only one side of the paper should be used. Paragraphs and page numbers should follow the format of this paper. Headings should follow this format:

Summary (or) Contents (or) Introduction

Second order headings

Third order headings

Fourth order headings

It should be noted that all cover pages will be prepared by the Organizing Committee.

Illustrations

Papers may be accompanied by essential illustrative and tabular material for purposes of clarification. The Organizing Committee reserves the right to reduce or eliminate such material in the interest of brevity or to make possible reproduction of the paper. Line drawings or graphs should be prepared in black India ink on good-quality paper. They should be inserted at the appropriate place in the text, at the size desired for reproduction.

Bibliographical references

All literature drawn on in the preparation of the paper should be acknowledged in the bibliography alphabetically by author, as follows:

Barret, W.H.G. & Golfari, L. Descripción de dos nuevas variedades del "Pino de Caribe." *Carib. For.* 23(2): first and last pages of article.
1962

Honig, P. *Principles of sugar technology*. Amsterdam, Elsevier. 2 vols.
1953-59

Leraillez, P. *La conservation industrielle des fruits*. Paris, Baillière. 347 p.
1952

Kemp, R.H. *et al.* Current activities and problems in the exploration and conservation of tropical forest gene resources. *In* Burley, J. & Styles, B.T., eds. *Tropical trees: variation, breeding, and conservation*. London, Academic Press, p. 223-233.
1976

Submission

Each paper should be submitted via air mail as indicated below:

Original to

Mr. Lukito Daryadi
Secretary-General
8th World Forestry Congress
P.O. Box 3668/JKT
Djakarta, Indonesia

Three copies to

Mr. Oscar Fugalli
Associate Secretary-General
8th World Forestry Congress
c/o Forestry Department of FAO
Via delle Terme di Caracalla
00100 Rome, Italy

ENVIRONMENT

Environment ministers of EEC agree on new five-year programme

Environment ministers of the nine European Common Market countries have agreed on a new five-year programme that foresees an expansion of joint regulations and activities in many new areas, including the requirement of an environmental impact statement for major projects.

Meeting at the headquarters of the European Economic Community (EEC), the officials also agreed to have the group ratify the Rhine and Mediterranean anti-pollution treaties and undertake a systematic study of the lead intake into the bloodstream of the EEC population. But the ministers managed only to begin difficult negotiations on legislation to curtail pollution from titanium dioxide and paper pulp industries and on water standards.

The new five-year programme that will guide EEC environmental action from 1977 to 1981 was publicly introduced in March by the EEC Commission officials who drafted it. Although a continuation of the previous EEC activities that concentrated on water pollution, it now incorporates new or enlarged plans in a variety of new sectors. These include proposals to combat noise, air and waste problems, environmental issues in developing countries, land use, and the institution of a European environmental impact statement. The special problems of urbanization and agricultural modernization will also be studied and acted upon.

Massive tree-planting programme in Athens area

The Greek Government has announced an ambitious programme to increase the woodland of the Athens area and improve its dangerously polluted environment. A total of 11 million trees, mostly pine and cypress, are to be planted on 11 329 hectares of hillocks around Athens, increasing the city's greenery from 2.5 to 10 percent.

Deer not put off by irrigation with municipal wastewater

Two experts who investigated the influence of wastewater irrigation on the quantity and quality of forage production, and white-tailed deer feeding response in central Pennsylvania, have found that semi-free ranging deer did not seem to be deterred from using the area irrigated in this way.

"There was no indication that they were repelled by the appearance of the irrigation equipment, the periodic process of irrigation, or any odours that might be associated with the chlorinated wastewater," Richard L. Dressler and Gene W. Wood, of Pennsylvania State University, said in a report published in the Journal of Wildlife Management (October 1976).

A little-known world of plants

Underexploited tropical plants with promising economic value

Report of an *ad hoc* panel of the Advisory Committee on Technology Innovation Board on Science and Technology for International Development, Commission on International Relations, Report No. 15. National Academy of Sciences, Washington, D.C., 1975. 188 p. Postage and handling charge $0.50 in the United States and $2.50 elsewhere.

This book is about a little-known world of plants, both wild and domestic, the variety of which is staggering. A variety of considerations weighed in the selection of plants described. These included their potential as food for humans, as animal forage, as industrial raw material, the ability to grow in the tropics, and multiple properties enabling several useful products to be obtained from a single plant. Medicinal plants and timber species are not included. Economic considerations for selecting the plants were relegated to the background, except in the most informal and subjective manner, because of the difficulty in determining future costs and benefits of exploiting these plants in vastly dissimilar environments.

Each of 36 plants is presented in a separate chapter giving a short description and touching on economic importance, limitations and special requirements and the research needs. The plants range from little-known to familiar species whose full potential has yet to be realized. The choice of species is obviously subjective, a fact which the authors themselves admit. It leans heavily toward Latin America. Asia and Africa abound in plants that have similar potential but have not been given adequate coverage, which they deserve. The plants have been grouped according to the use the major economic product they yield is put to, as (*i*) cereals and pseudocereals, (*ii*) roots and tubers, (*iii*) vegetables, (*iv*) fruits, (*v*) oilseeds, (*vi*) forage crops, and (*vii*) other uses.

The first group comprises plants yielding nutritious grains, and in some cases the entire plant makes an excellent hay. *Echinochloa turnerana* and *Zostera marina* are of special significance in that the former needs a single deep watering to develop from germination to harvest and as such is most suited to arid regions, while the latter plant is one of the few that grows fully submerged in seawater. Using the sea to grow grain is a novel and highly speculative concept and *Zostera marina* holds potential as a food crop.

The next group comprises plants that yield edible roots and tubers which are an important carbohydrate foodstuff, and may be boiled, baked or fried in oil or used as ingredients in stews. *Colocasia* species have a particular potential for marshy waterlogged regions and also coastal and salinified regions.

Grouped under vegetables are some interesting plants such as *Psophocarpus tetragonolobus* and certain plants yielding "palm-hearts." The first plant yields edible seeds, pods and leaves with usually high protein levels and is possibly the tropical counterpart of the soybean. The "palm hearts" (harvested from *Enterpe*, *Bactris*, *Cocos*, *Aerocomis* palms) are a

XIQUE-XIQUE (*Cerrus horridus*) CACTUS FOUND IN NORTHEASTERN BRAZIL, PEELED FOR ROASTING AND EATING

tropical delicacy. There is an ever-increasing demand for expensive exotic foods throughout the world and the demand for "palm hearts" exceeds supply.

Forming the fruit-group are species such as *Garcinia mongostana*, *Citrus grandis* and *Annona muricata* which yield highly flavoured fruits and have export potentials. *Guilielma gasipaes* yields a chestnut-like fruit, which is considered the most nutritionally balanced of tropical foods. This tree is eminently suited to wet tropics and, once established, requires little care and yields well.

Plants producing oilseeds are wide and varied. They include palms, desert plants and perennials. *Orbignya speciosa* seeds produce oil similar to coconut oil, but the labour required for seed collection and the unusual hardness of the endocarp are obstacles to its increased use. *Simmondsia chinensis* deserves special mention in that its seeds contain liquid wax that has impressive industrial potential.

Among the forage-yielding plants, *Acacia albida* and *Prosopis tamarugo* deserve special mention. The former is verdant with foliage and fruit during the dry season and its leaves and pods are often the only fodder available at that time. The latter species, native to the Atacama Desert in Chile, grows through a layer of salt, sometimes a metre thick. In fact there are few useful plants that can survive the extreme conditions of the plants' native habitat.

Included in the last group are palms, grasses and algae that yield a variety of products such as fibres, wax, protein, starch and rubber. *Parthenium argentatum* deserves special mention. All parts of the shrub contain a rubber, virtually indistinguishable from natural rubber from *Hevea* trees. It is a potential source of rubber for arid lands, but acquisition of processing technology is a major hurdle to its wider exploitation. Mention may also be made of *Spirulina* blue-green algae, which could be used as food for human consumption. They grow in brackish and alkaline waters and are rich in protein and vitamins.

One of the most important features of this book is that it brings out clearly the limitations and special requirements of each of the species it describes, factors which have been impediments to the realization of their full potential. These impediments fall into specific categories.

I. Lack of adequate agronomic and/or horticultural knowledge, such as absence of improved varieties for sustaining high yield, the number of years required for the plant to mature and yield the raw material, inadequate information concerning conditions governing growth and yield, susceptibility and/or resistance to diseases, and lack of vegetative propagation.

II. Technical problems, such as those requiring tedious manual labour and long hours of work in an uncongenial environment or problems of inadequate processing technology.

III. Nutritional limitations, such as insufficient information on nutritional factors, toxicity, palatability, and inadequate food technology.

IV. Economic factors such as low financial return to growers and producers.

V. Environmental consequences such as the effects of introducing plants to new regions where they may become a weed; serve as hosts to parasites and predators or become overly competitive with other plants.

Given concentrated research, the above-mentioned limitations could be largely overcome and many an underexploited plant could follow the developmental course of the soybean, which was considered an oddity at one time. This would make developing countries more productive and provide significant job opportunities. Export of processed goods would encourage setting up of subsidiary industries.

This is a book which is not only informative but makes interesting reading for the general reader concerned with plants as well as the specialist. It is also well illustrated, with many carefully selected photographs.

P. ARGAL

Concerning sick trees

Forest Pathology - principles and practices in forestry

by B.K. Bakshi. Published by the Controller of Publications, Delhi. Printed at the F.R.I. Press, Publicity and Liaison Branch, Forest Research Institute and Colleges, Dehra Dun, India, 1976. 400 p. Illustrated. Price Rs 21, UK£2.45, US$7.56.

This book is a welcome contribution to a subject of wide interest and importance. There has been a general lack of consolidated accounts of diseases of forest trees in the Indian subcontinent and Dr. Bimal Kumar Bakshi, forest pathologist and director of biological research at the Forest Research Institute and Colleges, Dehra Dun, helps to fill this void.

The volume is divided into three parts. Part I takes up general principles of forest pathology; Part II, which accounts for the major part of the text, deals with diseases of indigenous as well as exotic forest tree species of the region, and Part III covers microbial degradation of wood.

The book opens with a short description of the forests in India and proceeds to discuss the causes of diseases in plants, divided into two categories — parasitic and physiological or physiogenic disorders.

There is a useful chapter on broad principles of forest disease control. It is noted that prevention and control of forest tree diseases are all too often ignored because, in general, forest stands have a relatively low value per unit of area, as compared to agricultural crops.

However, intensive control measures are economically justifiable in nurseries and plantations where the crops have a high value.

The intrinsic value of this book lies in Part II which gives a comprehensive account of recorded diseases of forest tree species of the Indian subcontinent, both indigenous and exotic, including diseases that plague these trees in other countries. For exotic conifers which are mostly in the trial stage in India, diseases recorded in India only have been described.

The author has given a host-wise and not pathogen-wise account of the tree diseases commencing with diseases that are rampant in economically impor-

tant timber species. The discussion invariably begins with a short account of silviculture and management practices of the species and is followed by an account of range of distribution of disease, nature and extent of infection, damage and symptoms. Finally, measures for controlling the disease are indicated. For indigenous species of lesser economic importance some of these details are omitted. Discussion of pathogenic diseases precedes that of physiological disorders, the former receiving relatively greater attention, presumably because they have been studied at some length and also because the aggregate damage they cause to the forests is considerable.

The diseases treated here are as varied as their causes and are major biological determinants of forest productivity. Among the diseases dealt with are disease of *Santalum album*, which yields one of the costliest woods in the world and whose very existence is now threatened, *Ganoderma* root rot of *Acacia catechu* and *Dalbergia sissoo*, *Polyporous shoreae* root rot of *Shorea robusta*, pink disease of *Eucalyptus*, blister rust of *Pinus wallichiana*, *Fomes annosus* root and butt rot of *Cedrus deodara*, damping-off disease of seedlings in nurseries, cankers of *Cupressus* and Juniper species and woody gall of *Terminalia belerica*. Also covered are physiological disorders such as water blister of *Tectona grandis*, gummosis of *Eucalyptus* species and large-scale dying of *Shorea robusta*, to name a few of the more common and destructive diseases. These diseases have been discussed at varying lengths depending on their relative importance, but there is, quite naturally, a tendency on the part of the author to emphasize diseases with whose investigations he has been associated or of which he has personal experience.

A useful reference work distinguished by a lucid presentation, the book is furnished with clear, informative and well-chosen illustrations. However, in the text there are avoidable repetitions that are distracting and prevent smooth reading. The author also provides an excellent bibliography of published literature on plant pathology and allied subjects and makes copious references to these sources in the text.

P. ARGAL

unasylva manuscript style

unasylva
an international journal of forestry and forest industries, is published quarterly in English, French and Spanish editions.

Language and writing style

Manuscripts are accepted in English, French or Spanish. Well-organized and clearly written manuscripts not only help to communicate ideas and information to the reader, but they facilitate editing and translation.

Manuscript preparation

Manuscripts should be in duplicate, typewritten double-spaced on one side of the page only and with wide margins. About 250 words to a page will simplify word-count estimates. It should be possible for us to make clean, easily read photocopies from any manuscript, therefore please use a new typewriter ribbon. The first page should have in the upper right-hand corner the author's name and address, the date and the number of words in the main text, not including words in tables, figures, captions or titles. Subsequent pages should have only the author's name in the right-hand corner.

Metric system

All measurements should be in the metric system.

Tables, figures, drawings

Tables, figures and drawings of any kind should each be on a separate page and numbered to correspond to their points of reference in the text. They should never be pasted into the body of the text. They should be as clear and simple as possible. Only essential tables and figures should be included and all should be identified as to source.

Photographs

unasylva uses black-and-white photographs. We prefer good quality black-and-white prints 18 × 24 cm (8 × 10 in) on glossy paper. If a diapositive colour-slide is of high quality we may be able to make a copy negative from it and a good quality black-and-white photograph, but we prefer not to have them. We will make every effort to return colour slides and black-and-white negatives but we cannot guarantee return. Black-and-white prints are not returned.

Footnotes and references

Footnotes and references should be listed on separate sheets at the end of the manuscript. Footnotes should be kept to an absolute minimum and we prefer none. References should be strictly relevant to the article and should also be kept to a minimum. For style of references please see examples in the magazine.

Length

Long articles are 3 000 to 4 000 words, and short articles are 750 to 2 000 words.

Republished articles

unasylva prefers original articles but does not rule out reprints, especially where there is the possibility of exchanging views and developments of basic importance in forestry and forest industries between readers in developed and developing regions of the world or where language considerations are involved.

Queries in advance

We welcome letters from writers suggesting ideas and subject matter for proposed articles. They usually result in articles of a higher quality and in a saving in writing and editing time.

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— Forestry schools and institutes, both through their libraries and subscriptions to individual staff members.

— Forest industry companies dealing with services for forestry, companies dealing in forest products.

— Individual professional foresters, especially those concerned with international forestry.

— Editors of professional and trade journals dealing with forestry, forest industries and environmental conservation.

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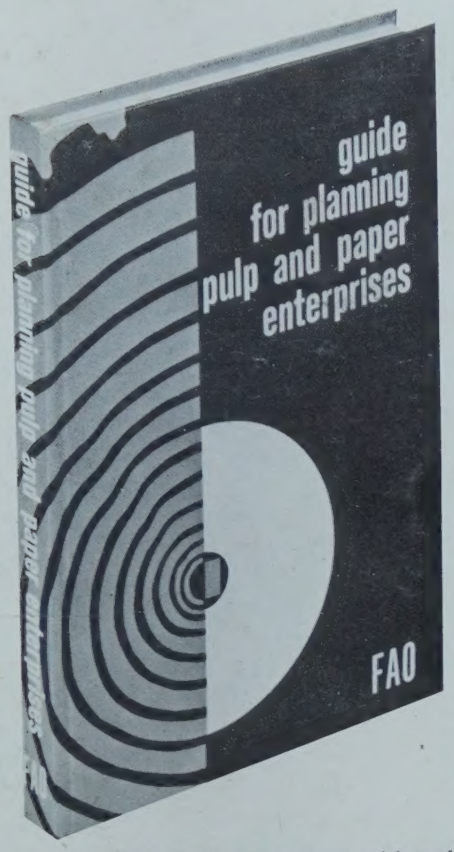

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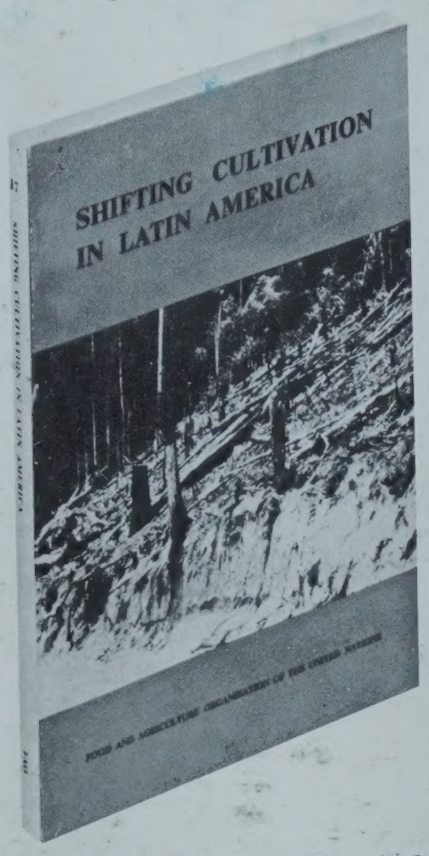

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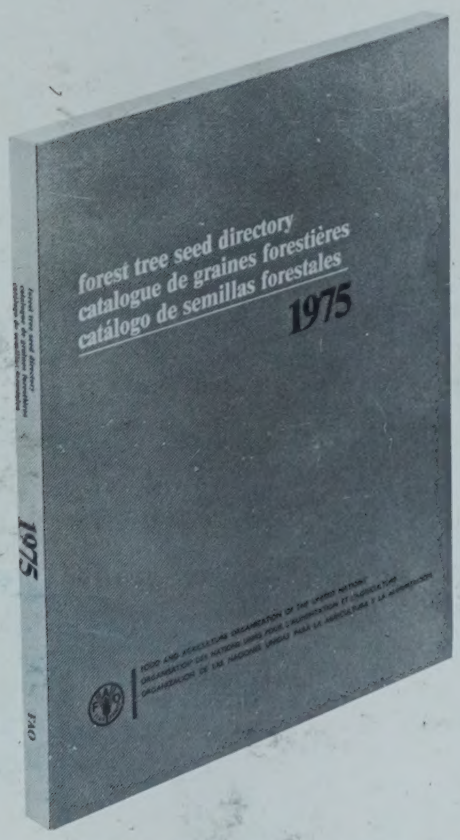

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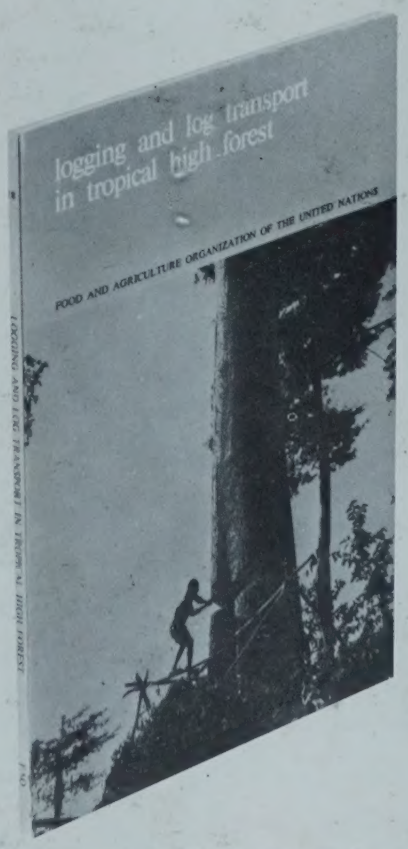

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